THE MODEL ENGINEER

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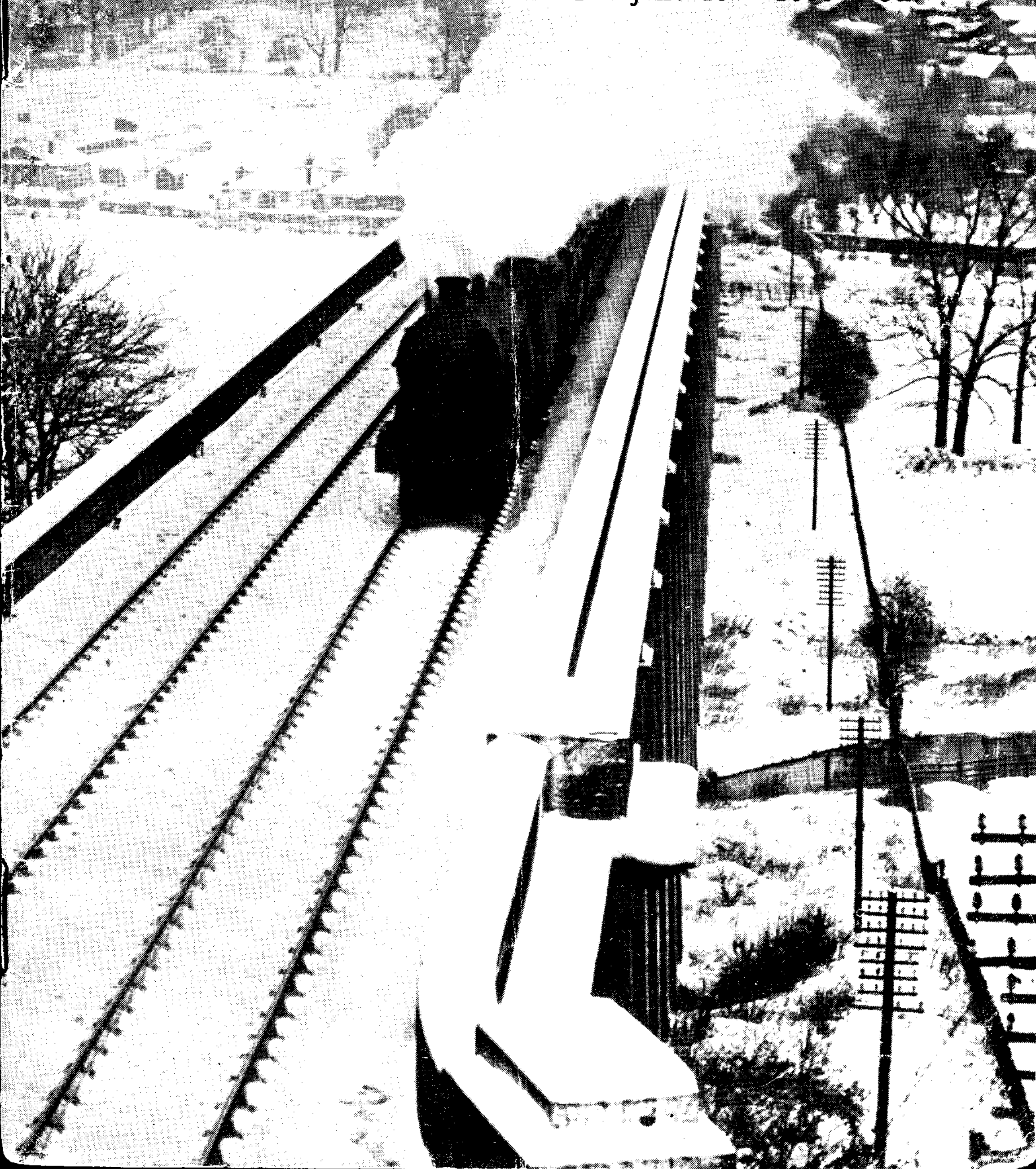

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

19TH JANUARY 1950 VOL. 102 NO. 2539

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SMOKE RINGS

Our Cover Picture

● A FAMILIAR railway structure seen from an unusual viewpoint, and in a seasonal setting, is depicted in our cover illustration this week. The train, which is a northbound passenger train from Kings Cross and is headed by an *ex*-G.N.R. Atlantic locomotive, No. 4456, is seen crossing the imposing Welwyn Viaduct.

It is interesting to note the footprints in the snow on the left-hand side of the picture; obviously, a linesman has been along to oil the signal-wire pulleys, a precaution that becomes a necessity in very cold weather

An Unusual Formula

● THE NEW examination syllabus announced last year by the Institution of Engineering Draughtsmen and Designers has now come into force. We are rather intrigued to notice that, with certain exceptions, as set out in the 1950 edition of the "General Information Booklet," admission to the Institution is now governed by the new "formula" which is expressed thus:

$$\frac{\text{DOE}}{\text{WST}} + \frac{\text{EXN}}{\text{HNC}} = \text{A.M.I.E.D.}$$

Reduced to ordinary prose, this "formula" may be translated thus: "Drawing Office Experience based on Workshop Training plus Examination (or Exemption) based on the Higher National Certificate standard is equal to Associate Membership of the Institution of Engineering Draughtsmen and Designers. After making a substitution of ONC for HNC, the "formula" is applicable to the rules governing admission to the class of Graduateship.

Honour for a Contributor

● WE HAVE been very pleased by the news that one of our readers, who is not an infrequent contributor to our pages, has had two of his models accepted on loan for exhibition at the Science Museum, South Kensington.

The models are the Leyland Cub fire-engine and Bayley escape made by Mr. S. A. Walter, of Wembley, and exhibited by him at last year's "M.E." Exhibition, where they were awarded a silver medal. We understand that they will be on view at the Museum within the next few weeks.

A Proposed Society for Spenborough

● MR. TOM SENIOR of Liversedge, who needs no introduction to our readers, has written to say that there is a proposal to form a Spenborough Society of Model and Experimental Engineers. A special general meeting to discuss the matter has been called for Monday, January 23rd, 1950, at the Temperance Hall, Cleckheaton, Yorks; time, 7.30 p.m. Any interested readers in the locality are cordially invited to attend, and we hope that, eventually, we may learn that the proposed society is established.

Traction Engine Enthusiasm Spreads

● THERE CAN be few people today who have any doubt as to the enormous popularity of the traction engine, not only as a prototype for modelling, but also as an undying topic for discussion and conversation. The existence of the Road Locomotive Society, a strong and active body of enthusiasts of all ages who are devoted to the subject, is a significant " pointer," and a large portion of our postbag each week consists of letters containing queries, photographs, anecdotes and news dealing with all phases of the history, construction or present whereabouts of traction engines of all kinds.

This enthusiastic interest, however, appears to be expanding, and we have lately had some indication of its rapid growth in America where Mr. Floyd Clymer, publisher, of Los Angeles, California, U.S.A., has compiled an " Album of Historical Traction Engines." This book consists of 160 pages and contains upwards of 600 illustrations comprising English and American traction engines of all kinds, reproductions of pages from catalogues, facsimile advertisements and other interesting old documents. It is priced at $2.50 (about 18s. in English money) and, to the enthusiast, is probably worth much more. The point is, however, that it is announced as " No. 1," indicating that at least one more " album " is contemplated ; in fact, the author states that he actually possesses enough material for another. Moreover, no publisher today, even in America, would undertake to produce such a work unless he were sure of the market for it ; this fact is conclusive evidence of the degree of enthusiasm in the U.S.A.

It is one of the curiosities of human nature that, very often, the products of skill and ingenuity are but little appreciated until they are either threatened with extinction or become extinct. To a great extent, this applies to the traction engine, the gradual demise of which has given rise to a tremendous growth of interest and enthusiasm which excited only a comparative few when the traction engine, in all its forms, was a potent factor in the lives of us all !

The Call for Skill

● A VERY prevalent fallacy at the present time is the idea that the skilled worker is becoming unnecessary in modern industry. On the contrary, the need for skilled craftsmen was never greater than it is now, and there is a serious shortage of such workers in all engineering and allied technical factories. As a result, many firms are paying particular attention to ways and means of attracting young workers to take up training in skilled craft, and schemes for apprentice and student training on the most up-to-date lines have been evolved to conform with present industrial needs. We have just read an interesting booklet on this subject issued by the English Electric Group of Companies, one of the largest industrial organisations in this country, employing over 35,000 workers, including several thousands of apprentices in all branches of electrical and mechanical craftsmanship. The booklet describes the various courses of apprentice training, the conditions under which training is carried out, and the prospects for the skilled worker of the future. Our personal reactions to this information were, primarily, a reaslisation of the contrast between the industrial conditions now and those in the period of our own novitiate ; the vastly better opportunities for the apprentice to learn and qualify for better positions in skilled trade. Not only the youth in search of a career, but also parents anxious to set their sons on a sure and progressive path in life, should take notice of the opportunities offered in skilled craftsmanship. The possibilities of advancement to high positions in industry, as the reward of skill, diligence and enterprise, are, contrary to general opinion, better if anything in skilled manual trades than in office work. It is true that the merits of the craftsman have often failed to obtain recognition, or to obtain their due reward in industry, but quite apart from material benefit, the craftsman, more than any other worker, can find real happiness in his work, and enjoy the pride of craft and the satisfaction of achievement. We do not single out the scheme organised by the English Electric Group as necessarily better than that of any other company, but their illustrated brochure " The Call for Skill and Ability " certainly puts the case very vivdly, and can be recommended to all who are interested in an engineering career. It can be obtained from the English Electric Company Ltd., Queens House, Kingsway, London, W.C.2.

A Coventry Film Scheme

● MR. W. J. DEAN, hon. secretary of the Coventry Model Engineering Society has written to tell us that, among the members of that society, several have taken film shots at various regattas and exhibitions, and would like to make contact with members of other clubs who might have done the same thing in their own localities.

The object is, if possible, to arrange an entertainment at some suitable venue, where all these films could be shown and, maybe, give glimpses of such grand events as Bournville, Victoria and other regattas, for the benefit of people who were unable to attend the actual events.

This seems to us to be a good idea that might easily develop into something even better. Anybody interested in the scheme is invited to get into touch with Mr. Dean, whose address is : 52, Morris Avenue, Wyken, Coventry, Warwickshire.

More News from Old Oak Common

● SINCE OUR previous notes about the Old Oak Locomotive Club were published on November 10th, we have been informed that the membership is not wholly confined to enginemen and staff on the Western Region. Anybody within easy reach of Old Oak Depot is eligible for membership, so long as he is prepared to observe strictly a few simple but obviously necessary regulations. For example, membership of the club does not give anybody the right to wander about the depot.

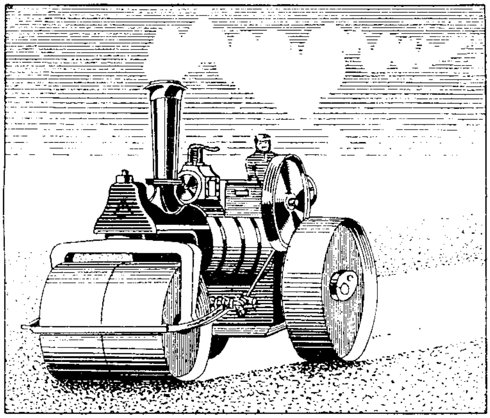
Pending the results of negotiations now in hand regarding premises and permanent workshop facilities, we would make it plain that present arrangements are of a temporary nature.

Mr. V. Chellingworth will be pleased to give further information to anyone desirous of joining the club. His address is 74, Noel Road, West Acton, London, W.3.

An

Out-of-the-Rut Road Roller

by B.C.J.



" The rumbling steam roller "

WHENEVER one's thoughts turn in the direction of engines designed to propel themselves along the high road as model-making possibilities, it happens not infrequently that the steam roller holds the attention—even more so perhaps than the much-modelled traction engine.

There is indeed something attractive and imposing about this massive machine as, with slow and steady speed it rumbles its way along the high road, its forepart swaying from side to side, its gears clanking, its polished brasswork and flywheel rim flashing in the sunlight, its nearly concealed mechanism giving forth attractive mechanical music, and not least its imposing tapered chimney throwing out light puffs of vapoury steam accompanied by the *chuff-chuff* that so charms the mechanically minded.

But, alas ! the steam-roller is slowly, but surely, giving way to the oil-engine-propelled roller. It had to be so. The oil-roller, with its internal combustion engine, is in every way a very satisfactory machine and readers of THE MODEL ENGINEER do not need to be told that it makes a very satisfactory model. We have seen not a few of these described and illustrated in the pages of THE MODEL ENGINEER in recent years. Still, it is a sad thought that the ubiquitous steam-roller of our younger days is being driven on to the scrapheap by the more modern machine. Can one not imagine the heartrending screams of the steam-roller—delivered by its whistle—as it hastens along the road, pursued by its modern adversary, to finally crash with much rending and tearing of metal on to the scrapheap.

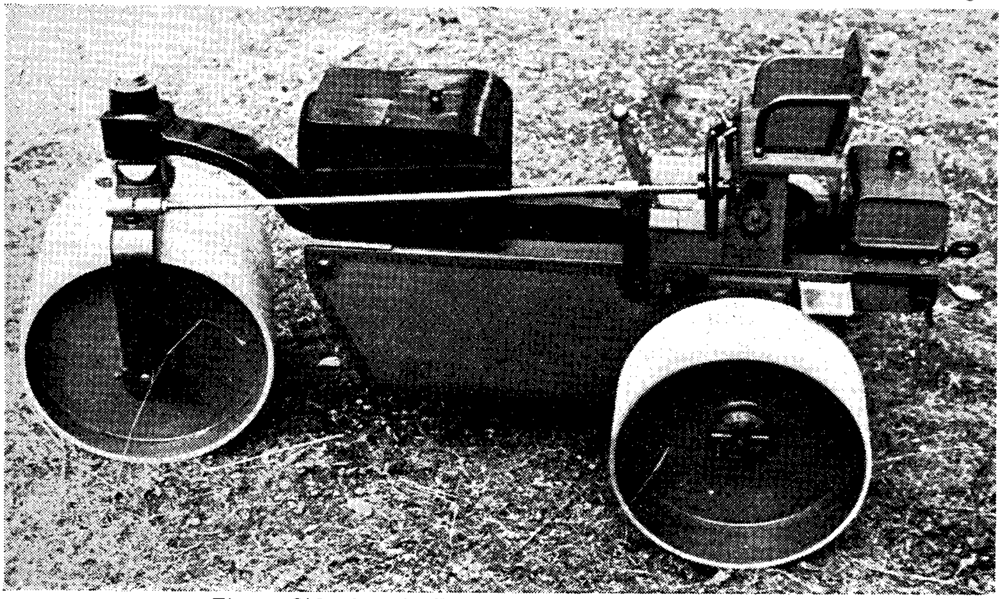


Fig. 1. Side view of roller, showing simple steering mechanism

(I know this is not precisely what happens—but let it stand.) So good-bye steam-roller with your rumbling and clanking, puffing journeys to and fro flattening the road surface, and now in a manner of speaking, to be flattened yourself!

Now it had long been a dream of mine to possess a model steam-roller. But it seemed that the whole chassis and transmission system were built round the engine.

The first step was to stretch a piece of paper on a drawing board and perform a bit of scheming and head-scratching, such as has occurred on many previous occasions. The resulting drawing having received the approval of the entire designing staff—myself—it became necessary to visit

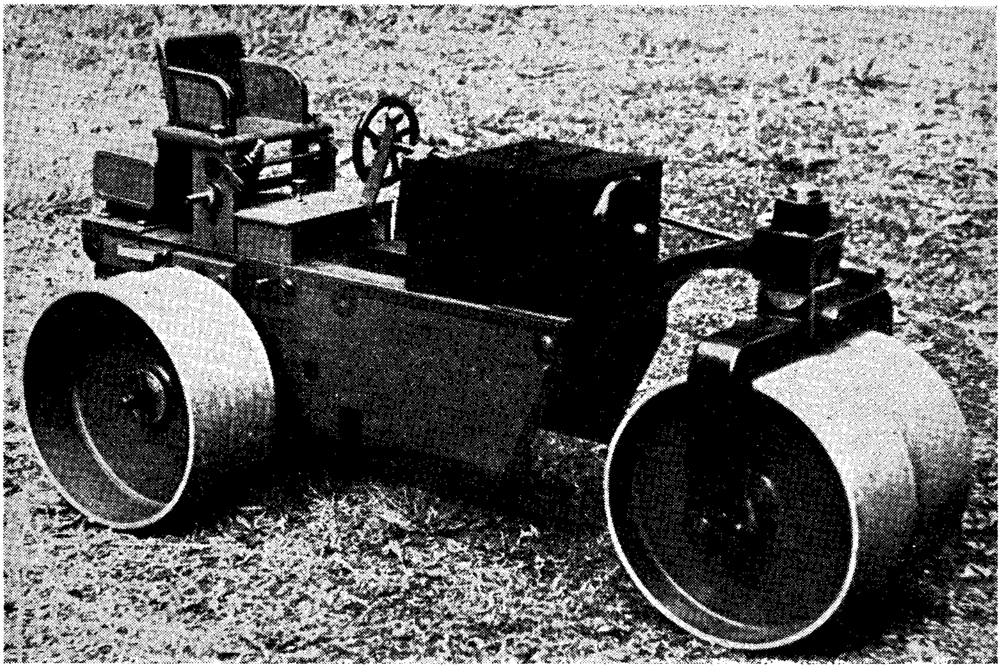


Fig. 2. Front end view of roller, showing bracket and fork for front roll

that this could only be accomplished on the beg, borrow or steal plan. Rollers advertised for sale cost too much money. A roller could by no means be manufactured in my workshop—the equipment was not available and maybe experience of the right sort was wanting. So the whole matter was kept in abeyance and nothing materialised.

Then something happened. I was on a visit to a neighbouring town and seated in a park-like place, my attention was drawn to a sizable motor road-roller at work, up and down, flattening a short length of roadway. I studied this machine with a great deal of interest—I think the driver had an idea that my intention was to appropriate it.

Well, the result of this visit was that I decided to build a roller of some sort—a steam-roller, an oil-engined roller, an *out-of-the-rut* roller—but in any case a *roller*. I am not sure that I did not even consider the possibility of driving my roller by *wind power*. However, I did not pursue the wind power idea but I developed a form of power nearly as simple, I made use of a small air-engine that was at the time lying idle in my workshop. Indeed, I think I may say certain engineering people in a neighbouring town. Here I purchased the following: $1\frac{1}{4}$-in. $\times$ $\frac{1}{4}$-in. angle iron, two pieces of $\frac{1}{8}$-in. mild-steel plate cut to size, two lengths of $\frac{5}{8}$-in. mild-steel shafting, a quantity of $\frac{1}{4}$-in. bolts; and in addition to these purchases I gave an order for four rolls 9 in. diameter by 4 in. wide. These, using a pulley for a pattern, were cast in aluminium alloy. My desire was to keep the weight down within reason for it will be realised that there was not much power available—there was very little power available. The question of weight suggests a digression.

Before spending time and money and mental effort on my proposed *out-of-the-rut* machine I thought it well to endeavour to arrive at some rather definite conclusion as to whether my engine was capable of propelling itself, plus a probably weighty chassis on the level. With this in view I made up a small three-wheeled platform, one wheel consisting of a wood grooved pulley about 7 in. diameter overall. I mounted the engine on the platform and connected engine and platform pulleys with a round section belt. The ratio of the pulleys was 4 to 1. I started up the air-engine and had the satisfaction of

observing this curious contrivance perambulate across my workshop floor from wall to wall. So I figured that allowing for chassis weight, transmission friction, slight inclines and rough surfaces that I should not be far off the mark if I made arrangements for a 20 to 1 reduction from engine crankshaft to rear roller axle—nor was I.

occupies a position which was originally intended for a water tank. The housing shown would accommodate a small petrol engine very comfortably.

Fig. 2 is a side view of the roller taken from the reverse side. This view well shows how the front roller fork is pivoted to the steering head-pin. The design hereabouts was entirely satisfactory and though quite essential to the proper working of the machine was in the first case nearly omitted as being thought to be redundant on a small scale machine.

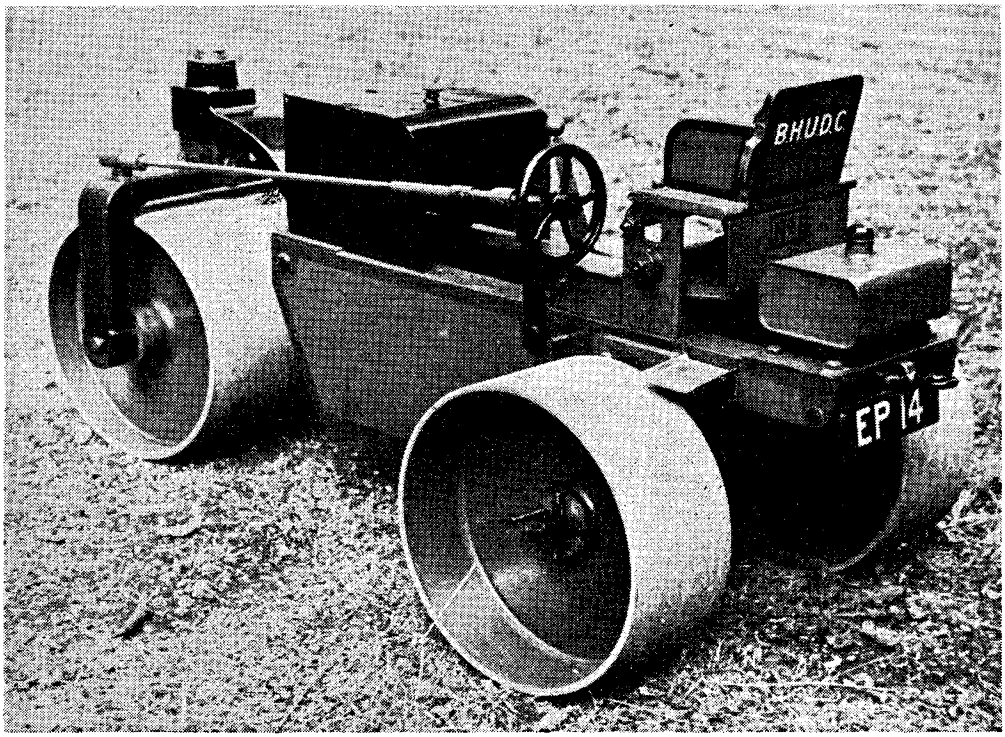


Fig. 3. View of roller from steering wheel side, showing driving pin on axle, fuel tank, driver's seat, etc.

Fig. 1 shows a side view of the roller. Here I feel it incumbent on me to say, as is fairly obvious, that the engine has been removed for reasons to be referred to later, and this applies also to Figs. 2, 3 and 4. This view shows in particular the steering mechanism and I do not think any will consider it intricate or liable to disorder. A handwheel-operated threaded member working in a bracket is flexibly coupled to a rod pivoted to a vertical pin on the leading roller fork. The handwheel does not occupy a constant position, but moves backwards and forwards according to the position occupied by the front roller. Certainly this would be inconvenient on a full size roller but is of no importance on a model.

The front roller pivot bracket has not quite the strong and graceful appearance which one could have desired, especially having in mind the kind of weighty casting associated with the steam-roller. But it is strong enough and is securely anchored to the frame—three bolts being employed.

The housing at the forward end of the chassis

This illustration shows the "clutch" lever with ball top, the reversing and speed lever near the front edge of the seat, and the shaft end on which the driving pulley was mounted. The driver's seat, an interesting little bit of woodwork, has a rather important function. It forms a cover for the transmission system and on withdrawal of the small plug shown the entire seat can be swung round so as to expose the friction drive, to be described later. It will be observed that there is a space between the floor-board and the front casing; this space was, in its working life, occupied by the engine propelling the roller, and this engine being both heavy and high detracted not a little from the appearance of the roller, and I think must be held largely responsible for the descriptive title—"out-of-the-rut."

Fig. 3 gives a good idea of the back end of the roller and clearly shows amongst other items

the fuel tank, the driver's step, the draw-eye, the number-plate and other details. Fig. 4 is a front view of the roller and this view gives an impression of the heavy front roller fork and its attachment to the swivel pin. This picture also suggests the somewhat rough nature of the ground with which the machine was expected to deal.

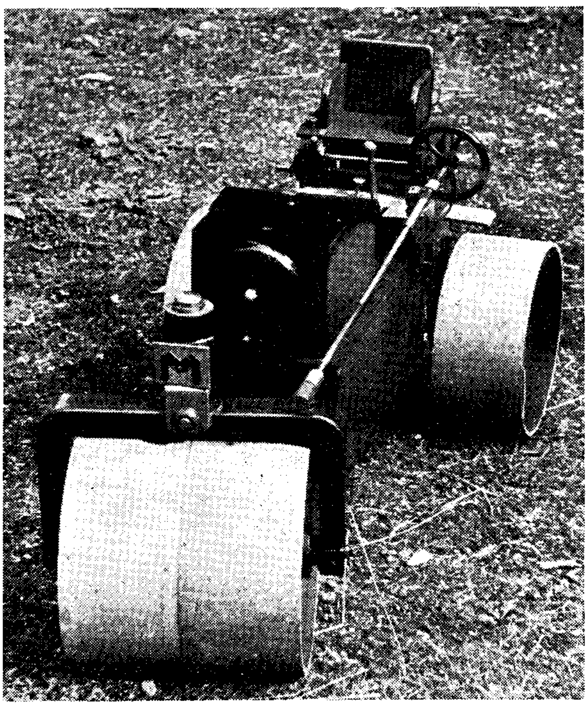


Fig. 4. Front view of roller

Patterns

Certain patterns were necessary and these with the assistance of practically no woodworking tools were made up in my pattern shop, fitting shop, machine shop, office—call it what you will.

I enumerate these patterns :—

1. Bearing bracket for rear axle, G.M. ; 2. Crown wheel and pinion bracket, G.M. ; 3. Bracket for steering head, Alum. ; 4. Pulley shaft and seat bracket, G.M. ; 5. Front roller fork, Alum.

Frame

The frame is a simple affair and consists of two lengths of $1\frac{1}{4}$-in. $\times$ $\frac{1}{4}$-in. angle iron united at either end by rectangular pieces of mild-steel 6 in. $\times$ 3 in. $\times$ $\frac{1}{8}$ in. thick. It is altogether a pretty stiff affair especially when the engine is bolted down on to it—I doubt whether it twists much when the roller is doing its turn on the road.

The Transmission System

Earlier in this article I remarked that the chassis was built round the engine, and now I have to admit that the transmission system was much influenced by the peculiar construction of the same engine. The engine was emphatically not built for propulsion purposes.

Owing to the low position of the displacer chamber—you will remember it was an air-engine—it was not possible to locate the pinion shaft horizontally, motor vehicle fashion. I was compelled to use a vertical shaft, and a short one at that.

Now if the reader will take a look at Fig. 5 he will observe a transmission system, not by any means orthodox. I will now proceed to describe the system with the aid of the lettered drawing, and I hope my descriptive matter will satisfy the average reader.

Very well then, *A* is the rear roller axle passing through a yoke *C* which at its upper end forms a bearing for the pinion—*B* is the pinion. The crown wheel is not shown but it can be imagined. Meanwhile there is no differential gear, in view of certain details to be later described, it was thought to be unnecessary. *D* is a square-section pulley shaft and on this shaft slides the small friction wheel *F*. The driving pulley is mounted on the projecting end of the shaft *E*. The small friction wheel is slid along the shaft by the fork *G* and the handle *L*1. Now *F*1 is a friction disc "slidably" mounted on the pinion shaft. The friction disc is held up to its work, i.e. held in contact with the small friction wheel by means of the ball-handled lever *L*, a ball thrust and a spring—both of these to be clearly seen immediately below the friction disc. *T* is a torque stay anchored to the frame rear member. And, finally, *K* is one of the frame side members. All this reads a little like a patent specification and I fear it is no less dry. There are people who would follow the whole idea from the drawing alone without a single letter of the alphabet being necessary to guide them !

In action, this is what happens. The small friction wheel is slid along the shaft to right or left according to the direction in which the roller is required to run. Then the lever *L* is pushed forward and held in a notched plate by a slight movement to the left, and thus the two friction wheels, driving and driven, are brought into contact. A little slipping occurs and off she goes, at a speed equivalent to about 2 miles per hour on a full size machine. This of course is the lowest gear and higher gears are provided by sliding the small wheel in the direction of the centre of the larger.

The two brackets one on each frame side-member not only embody the bearings for the square shaft but form supports for the driver's seat, these brackets may be clearly seen in all the photographs except Fig. 4. The mechanism as sketched in Fig. 5 worked fairly well and reversal could be accomplished quickly and easily,

but changing up to a higher gear usually brought about a cessation of movement of the entire vehicle—simply for the reason that the engine was incapable of dragging so heavy a load on so rough a road surface. There was a weak point in the design however. The pinion shaft was a short

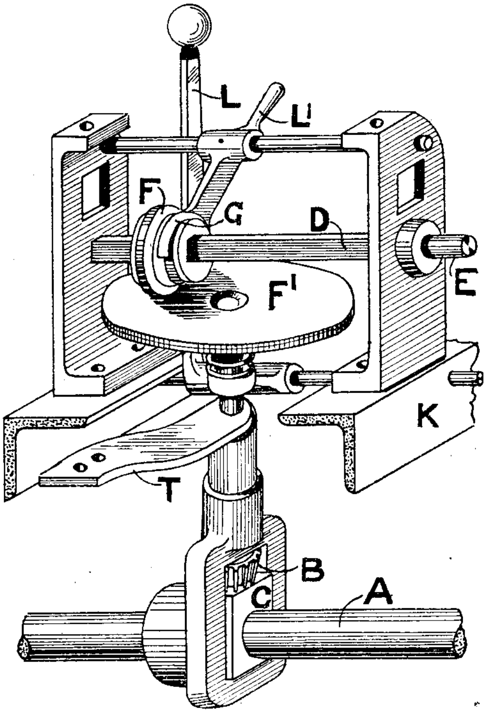


Fig. 5. View showing general arrangement of roller transmission system. Crown wheel not shown

one and the same remark applies to the boss of the larger friction disc and thus when pressure was applied to the underside of the disc, the whole thing canted over and brought about unsatisfactory running conditions.

An Improved Transmission

Now a little subsequent consideration of the problem suggested an improvement and this improvement is pictured in Fig. 6. Instead of lifting the disc *M* centrally, two ball bearing rollers *N* attached to suitable arms—the rollers being near the periphery of the disc and diametrically opposed—should improve matters. *O* is the operating shaft and *P* the pinion shaft provided with some suitable means for "slidability." I consider that the friction disc would be firmly supported in a horizontal plane with such a scheme. Peradventure I may put it to the test.

No Differential Gear

I have remarked earlier in these notes that a differential gear is dispensed with, and in its place a simple arrangement of engaging pins is employed. This device may be fairly well seen in Fig. 3. Each end of the axle has a stout parallel pin passed through it and the pins are made secure by a set-screw in each shaft end. Similar pins are driven into the bosses of the rolls—parallel to the bore in each case. This arrangement provided a little give and take when the roller was pursuing a comparatively straight course—either roller being free to overrun the other a little. Consideration however, will make it clear that the overrun—due to pin diameter—would amount to something less than 180 deg. It seemed to work successfully.

It was my intention that on occasion I would run the roller in a circle and this seemed easy of accomplishment by withdrawing the pin on the inner roll—the pins were a mere push fit in the roll hubs. But I was never able to properly test this circular trip proposal, and for the sufficiently good reason that the engine was incapable of pulling the roller—and it did weigh something—over the rough surface of the "roundabout." A pity this, for I am rather well satisfied to sit and smoke while, without any attention on my part, some machine works according to plan—and keeps on working.

Miscellaneous

There are yet a few details of construction which may be referred to. The crown and bevel wheels were obtained from a hand-drill and appear to have stood up well to the stresses imposed upon them on the back axle. The chassis and the interior surfaces of the rolls were painted light green and the chassis was bordered with a darker tone of green. The front fork was enamelled chocolate and the front casing black. The lettering on the back of the driver's seat is white and I leave the reader to interpret the meaning of the letters. The friction disc is leather covered and the small driving wheel was provided with a rubber ring—but I think something better in the way of material is called for.

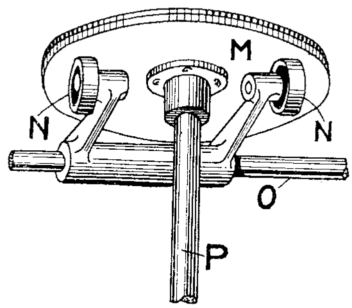


Fig. 6. Proposed improved transmission

As regards the weight of the roller—less engine—I can only hazard a guess; shall I put it at 50 lb.?

In Fig. 2 can be seen a small foot-pedal, this might be used as a brake since the lower part makes contact with the friction disc. However, I must confess that it sometimes served a more useful role for when the disc refused to drop into a position of disengagement, the pedal applied a little persuasion. Without such provision, anything might have happened

Dimensions

Since the photographs do not convey a very accurate idea of the size of the roller, a few dimension may be appreciated.

Overall length	34 in.
Width over rolls ..	16 in.
Height (to seat back) ..	17 in.
Width over frames ..	6 in.
Back rolls	9 in. × 4 in. wide
Front roll	9 in. × 8 in. wide

I have no records which enable me to give an idea of the cost of building this machine. Certain parts, the rolls for example, were specially made for me by an engineering firm in a neighbouring town; certain other parts were very skilfully made by a retired tool-maker not five minutes' walk from where I am compiling these notes: still other parts—with the assistance of all too few tools—I contrived to make in my own workshop here in M——. Other parts came from London and the remaining pieces just happened. Recently, having become tired of seeing the roller lying dormant on the floor of my workshop—eating its head off so to speak, I advertised it for sale complete—*but without engine.* I am still awaiting a purchaser!

I must finally inform the patient reader that it seems likely that this *out-of-the-rut* machine would not have come into being had I not had possession of a really first-class and lengthy track—no less than 110 yds. in length—on which the machine might demonstrate its capabilities. And further, there is in addition a circular track with a diameter of about 16 yds. With all this space available how sad is it to relate that the power unit of the roller was unequal to its task of dragging the weighty machine along. (It did go, however, where the track was quite level.)

Model railway enthusiasts will doubtless wonder why it has never occurred to me to lay a railway track along this fine length of garden pathway. The answer is—it has. But I would not have a ground level track—too much stooping and too much backache. An upraised track on trestles—too much expense. And too much expense involved in locomotive and rolling stock. For these reasons the road-roller seemed to be the best choice. And it had to be an inexpensive sort of machine and hence the unusual contrivance which has been described and illustrated in this article both with photographs and line drawings. It certainly is not to be expected that any reader of THE MODEL ENGINEER will, after reading this article, forthwith set to work to make a similar machine for himself. Still, these remarks may suggest to him that it may not always be the orthodox machine that provides the greatest amount of interest and pleasure in the making. It may be something entirely different. It may even be an *out-of-the-rut* machine!

For the Bookshelf

"Modern Ships," by F. E. Dean. (London: Temple Press Ltd.) Price 8s. 6d.

This is a recent addition to the Boys' "Power and Speed" Library, but it should not, therefore, be classed as a boy's book. The fundamental problems encountered in the planning and design of the ship are described in brief but lucid language, as is also the actual building of the ship. Following this comes a very interesting section dealing with the power plant and auxiliaries, the development from the early steam engines to the latest diesels being fully described. The remainder of the book is devoted to a discussion on the various types of ships from the largest liners to the smallest special purpose ships. The book will repay careful study by anyone interested in ships and the model maker who specialises in power-driven models of prototype steamships will find it a great source of inspiration. The illustrations are well chosen and contain examples of all types of ships and a few photographs of interesting details. A number of very clear line drawings are included, our only criticism being that in some cases the captions are omitted; although the section of an engine may be referred to in the text it is nice to have a caption under it saying which particular type of engine it is. The book is bound in cloth and is well produced, and is extremely good value at its price.

Modern Electric Clocks. (Fourth edition.) By Stuart F. Philpott. (London: Sir Isaac Pitman & Sons Ltd., Parker Street, Kingsway, W.C.2.) Price 15s.

The last two or three years have seen the introduction of an unprecedented number of books on horology, and electric clocks in particular. In the fourth edition of this book, the many recent developments in electric timekeeping are described, with special emphasis on systems of time distribution, time switches, recorders and the many miscellaneous applications of such devices in industrial process timing and similar cases. Other sections of the book deal specifically with marine clocks, turret clocks, synchronous motors, impulse clocks and secondary dials. A good general modern treatment of the subject, the book is profusely illustrated in line and half-tone, but we are sorry to see no mention whatever of the good old Hipp and other escapements for impulse clocks, which are not only of historical interest, but still hold a well-deserved place in individual battery-driven clocks.

Novices' Corner

Screws and Screw Threading

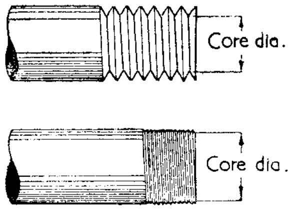


Fig. 1. The effect of coarse and fine pitch on core diameter

MANY novices appear to have difficulty in deciding the size and pitch of screw threads to use in their work. Thus, on examination, one often finds screws and bolts which are out of all proportion to the duty they have to perform.

The finer the pitch of the screw that can be employed, the less likelihood is there of

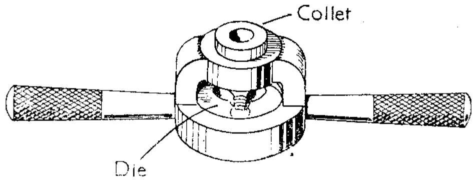


Fig. 2. Die holder fitted with guide collet

the screw or nut coming undone. Apart from this a coarse thread has not the mechanical strength of a fine thread of equal diameter owing to the reduction in cross-sectional area of the core, or solid portion of the screw. Fig. 1, which shows diagrammatically two screws of equal diameter but of different pitch, will make this point clear.

Range of Screw Threads for Amateur Use

The amateur is concerned in the main, with small mechanisms so may make use of fine thread screws with advantage. The range he will require for the general run of his work may be said to be from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. diameter. Fortunately the standard thread pitches available allow him ample cover in this respect and our recommendation is as follows :—

	Size	Outside Diameter	Threads per inch	
British Association (B.A.)	10	.067 $\frac{1}{16}''$ approx.	72.6	Standard Bolts, Nuts, Screws obtainable.
	8	.087	59.1	
	6	.110	47.9	
	4	.142	38.5	
	2	.185 $\frac{3}{16}''$ approx.	31.4	
British Standard Fine (B.S.F.)	$\frac{1}{4}''$		26	
	$\frac{5}{16}''$		22	
	$\frac{3}{8}''$		20	
	$\frac{7}{16}''$		18	
	$\frac{1}{2}''$		16	

Additionally, for small fittings, the MODEL ENGINEER Standard, which is, incidentally, finding increasing use commercially, is obtainable in all fractional sizes by increments of 1/32 in. from $\frac{1}{8}$ in. to $\frac{1}{4}$ in., thence by $\frac{1}{16}$ in. increments to $\frac{1}{2}$ in. diameter. No commercial bolts or screws are available in this pitch, but certain firms stock a range of fittings threaded 40 t.p.i. The pitch of the larger sizes has recently been the subject of modification, resulting in some firms' fittings being threaded 32 t.p.i. for diameters of $\frac{5}{16}$ in. and $\frac{3}{8}$ in. and 26 t.p.i. for diameters of $\frac{7}{16}$ in. and $\frac{1}{2}$ in.

Readers with some knowledge of these matters will see that the old Whitworth Standard has been omitted altogether; in general its pitch is too coarse and the more useful sizes, that is the smaller, are covered either by the British Association or MODEL ENGINEER Standards.

Choice of Screwing Tackle

The newcomer is, to-day, in a somewhat unfortunate position with regard to screwing tackle. Whilst the dies and taps, as the cutting units of the equipment are called, are, in general, above reproach, the same cannot be said of the die-stocks which are used to hold the dies used for cutting threads on rods or tubes. Before the war, when American supplies could be

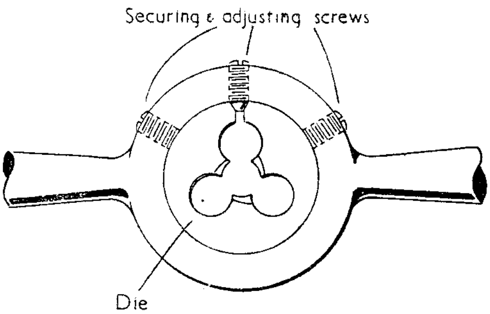


Fig. 3. Method of securing and adjusting a die in its holder

obtained, it was possible to buy die-holders fitted with collets. These collets fitted into a recess formed in the die-holder, and, being of the same nominal diameter as the rod to be threaded, allowed the die to be started squarely on the work. Fig. 2 shows an example of a holder so equipped. Nothing we have seen in recent months suggests that this type of die-holder will be obtainable in the future. The novice must therefore be content with a plain holder and

rely on his skill, and such help as we may be able to give him, to keep the die square with the work.

When buying screw tackle the best plan is to put oneself into the hands of a reputable firm of tool merchants. Failing this the help of a knowledgeable friend should be sought, as his assistance in selecting good quality equipment will avoid subsequent disappointment.

Most modern screwing tackle is supplied with circular split dies which may be adjusted within limits by means of pinch screws fitted to the die-holder. The dies themselves are made with standard outside diameters, and the bigger the diameter the more does the die cost. The standard dies are $\frac{13}{16}$ in., 1 in. and $1\frac{5}{16}$ in. There are, of course, larger diameters, but these are outside most amateurs' requirements and it is possible to obtain some of the smaller threads in at least two of the die sizes. Quite apart from cost, the effect of using too large a die with its attendant larger holder is to make the equipment cumbersome and tiresome to use. The same holds good for tap holders.

In choosing a size of die suitable for the larger threads make sure of getting one with enough metal to guard against fracture. It is better to err on the large side than otherwise, remembering that due to hardening the mechanical strength of a circular die is limited. The best makes will give no trouble, for the manufacturers will have taken care to see that the dies are up to their work.

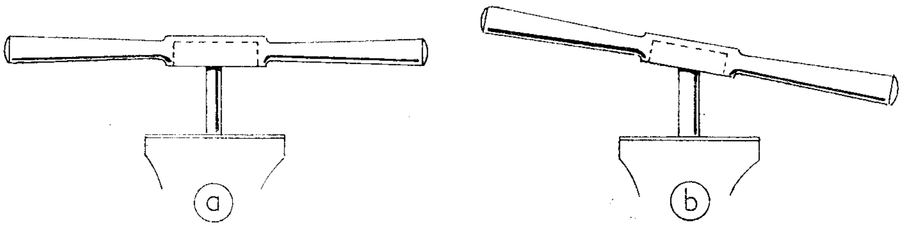


Fig. 4. Correct (a) and incorrect (b) alignment of die on work

Elementary Screw Threading

Let us suppose that it is desired to cut a thread on a piece of round rod. If the die we are going to use is examined it will be seen that there is a marked chamfer or lead formed on one of the entries to the die. This is the face to be presented to the work, so place the die in its holder with the chamfer side outwards, noting that the holder has a shoulder against which the die seats, this side of the holder should be uppermost. The die is held in its holder by three screws as shown in Fig. 3. It will be seen that the centre screw engages the saw cut in the die whilst the other two abut against the rim of the die. Now take the rod and file a lead upon it to correspond with the lead in the die. Take care to file as concentrically as possible, or the die may run out of truth. Grip the rod vertically in the vice, leaving enough protruding to allow it to be threaded. Place the die in its holder over the rod and turn the holder until it is felt that the die has begun cutting and is feeding downwards. If all is going well the alignment of the holder should be as in Fig. 4a. If not, and conditions resemble those shown in Fig. 4b, the alignment must be corrected by depressing the die-holder at the appropriate point and observing when the die has aligned itself correctly. If it has, turn on, applying oil, preferably a cutting oil, to the work, reversing the die by turning it backwards a quarter-turn for every two turns forward. This latter procedure breaks up the chips and allows the die to cut its correct size. At the outset do not cut more than 3 or 4 threads, but remove the die and try the thread for size by engaging it with its moving part. If the thread is a good fit, that is the moving part will screw on easily but without shake, then the die may be replaced on the work and the threading completed. If the thread is too firm take one cut for the full length of thread required and then screw the die off the work. The die will almost certainly shave something off the thread on its return passage, and this may be sufficient to provide a good working fit for the part.

If the fit is still too firm the die must be adjusted in its holder. This is done by the movement of the screws which retain the die in place. The die may be contracted and made to cut smaller if the two side screws are tightened and the centre screw slackened. Screwing the centre screw inwards will allow the die to expand and cut larger if the two screws on either side are correspondingly slackened.

Tapping Holes

Tapping is the operation of forming in a hole a screw thread of known size and pitch. It will be clear that in order to thread the hole at all its diameter must be less than the nominal size of the thread itself otherwise there would be no metal in which to cut the thread. The size of hole which must be drilled is, theoretically, the same as the core diameter of the screw which is to engage the threaded hole. In practice, this is not so since the drilled hole must be greater if difficulties in tapping are not to arise. These tapping sizes, as they are called, have been tabulated from time to time and in this connection we may point out that Messrs. Percival Marshall & Co. will shortly be issuing an up-to-date series of tables, in which not only are the standard tapping sizes given, but also alternative sizes to suit various classes of metal.

Experience has shown that the tapping sizes given in almost all tables are somewhat too small

for tapping, and, so far as the smaller sizes such as the British Association are concerned, it is possible to use a drill at least two sizes larger than that given in the tables and still have a perfectly tapped hole.

Taps are made in three types, taper, second and bottoming. The first has considerable lead, the second very little, whilst the last has none at all, to allow blind holes to be tapped.

Let us assume that a 2-B.A. hole is to be tapped in a piece of material. Looking at the tables, a No. 26 drill is given as the tapping size for 2 B.A. Therefore drill the material No. 26—or two sizes larger No. 24, No 26 will be a shade too tight—place a 2-B.A. tap in the tap-wrench and start to tap. As with the die, it is essential that the tap enters the hole squarely, so test it for alignment with a small square applied to the tap at two points at right-angles to one another. Pressure carefully applied will correct any inaccuracy. If the alignment is correct proceed with the tapping following the same method as for threading the rod.

If the hole being tapped is not deep then it should be sufficient to use the taper tap only. If, on the other hand, it is a deep hole then the taper and the second must be used alternately until tapping is complete. A long blind hole will require all three taps, the bottoming tap being use only then it is found that the second cannot be advanced any further.

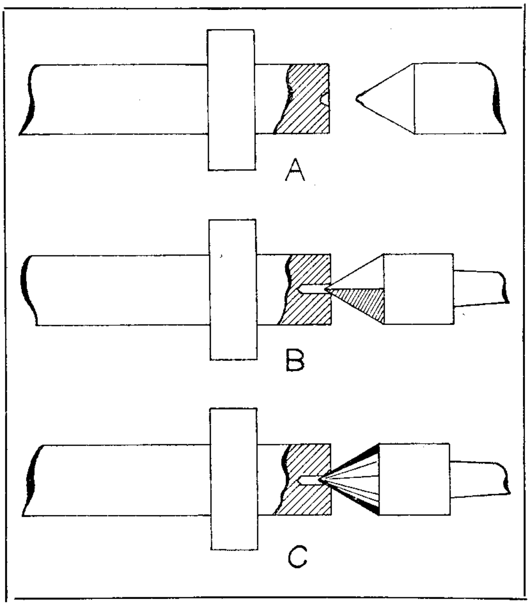
As previously described the working of the tap will raise the metal surrounding the hole and prevent any abutting surface from making uniform contact with the part in which the hole is tapped. For this reason, and before the tap is used, the tapping size hole must be opened out to full size for a depth equal to some two threads. This will prevent the tap from raising a burr round the hole.

We have mentioned the use of a lubricant when cutting threads. This varies with the material to be threaded, some metals requiring none at all. The following table shows the more common materials with their appropriate lubricants :—

Cast-Iron	..	None
Mild-Steel	..	Lard Oil
Silver-Steel	..	„ „
Brass ..	..	None
Bronze ..	..	„
Aluminium Alloy		Paraffin and oil mixture

Care of Lathe Centres

IF accurate work is to be expected from a centre lathe, it is most important that due care should be taken with centres. A centre should never be knocked in position by means of a hammer or piece of metal ; use a piece of hard wood. In order to prevent heavy wear on the poppet centre, due attention should be given to the correct method of forming the centres in the work to be turned. A badly-formed centre in the end of a spindle is indicated in *A*, of the accompanying illustrations. Here we have an example where the spindle has simply been centre-popped with a punch. The points of the lathe centres are jammed hard up to the work, with the result that the poppet centre will become worn and blunted, as clearly shown in view *A*. The centres in the work should be prepared by first drilling into the ends with a small drill, then cutting a true centre by means of the square cutting centre, as indicated in view *B*. The square centre is, of course, fixed in the poppet end of the lathe, and the centre formed in the work by revolving it, and putting the cut on by means of the poppet spindle wheel, using a little oil for lubricant. The centres, when made in the work in this manner, form a good bearing when revolved in the lathe centres, and the points project into the drilled holes, as indicated in view *C*. The centres in the work should be packed with grease to form a lubricant, and by taking this care, more accurate work is obtained, and above all the lathe centres will keep true.



W. J. SAUNDERS.

Overseas Picture Gallery

by "L.B.S.C."

YOUR humble servant often wonders what correspondents look like, and often tries to conjure up a mental picture of the person wielding the pen or "playing a tune" on the typewriter keys; so you can bet how pleased I was when our Montreal friend, Bill Leggett, sent me a whole pile of photographs taken at the recent annual meet of the New England Live Steamers at Danvers, Mass. Most of them included groups of members of our fraternity on that side of the big pond, and there were many close-ups of faces—and other parts of their anatomy, according to whether they faced the camera, or otherwise!—so I now have a pretty good idea of the identity of some of my correspondents. These, naturally, are more of personal than general interest; but included in the consignment, were a few that I thought would be of interest to the good folk who follow these notes, and here is a first small selection.

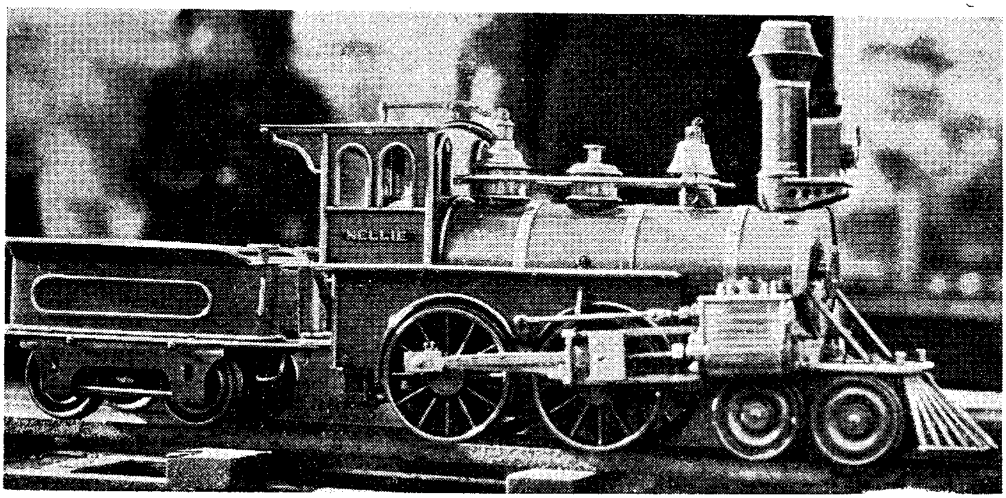


Photo by] [*A. W. Leggett*

Where did she come from?

Those of our readers who are interested in the old-time locomotives, should be rather intrigued with the two examples shown. *Nellie* is owned by Mr. A. S. Eldridge, of Weston, Mass., but her origin, and "date of birth," are lost in the mists of antiquity; it was before her present owner's time. She is certainly an interesting and unconventional old bit of goods; note how the unknown old locomotive-builder anticipated the "Atlantic" method of driving on the rear coupled wheel. Strictly speaking, this drive was not "original," as it dates back to the very early days of locomotive history; old *Invicta*, when she opened the Canterbury and Whitstable Railway in 1830, had the rear-wheel drive, but it was not combined with a bogie. No fair-minded person would compare that ancient and most honourable old lady who has "stood in this market-place for umpteen years," with the "Atlantic" type that was developed around the turn of the century. Note the peculiar arrangement of axleboxes and springs on the tender, and other unconventional items such as the arrangement of the safety-valve lever; an interesting "museum-piece" indeed!

The old Atchison Topeka and Santa Fé engine, *Wm. B. Preston*, is a much later version, with the conventional drive; but this engine has also many points of interest for the lover of old-timers. She was built by Mr. W. Morewood, of Bryn Mawr, Pa. (inteet to gootness, look you, if that town wasn't founded by somebody from the land of leeks, then I'm a Taffy!) and is truly representative of her days. Among items of interest are, the crosshead pump, tea-urn sandbox, diamond stack, and the built-up bar-framed tender bogies, or rather trucks, as our cousins over the big pond term them. Both *Nellie* and *Bill* have sandboxes but no pipes; it would have been an easy matter to add the pipes and valves, and would have been a great asset on the Danvers line. I understand that the rails are either duralumin or a similar alloy, naturally "greasy," and I have heard from several sources, that some of the engines had trouble through excessive slipping, or "losing their feet" as full-size enginemen say. I have found the working sanding-gear on my single-

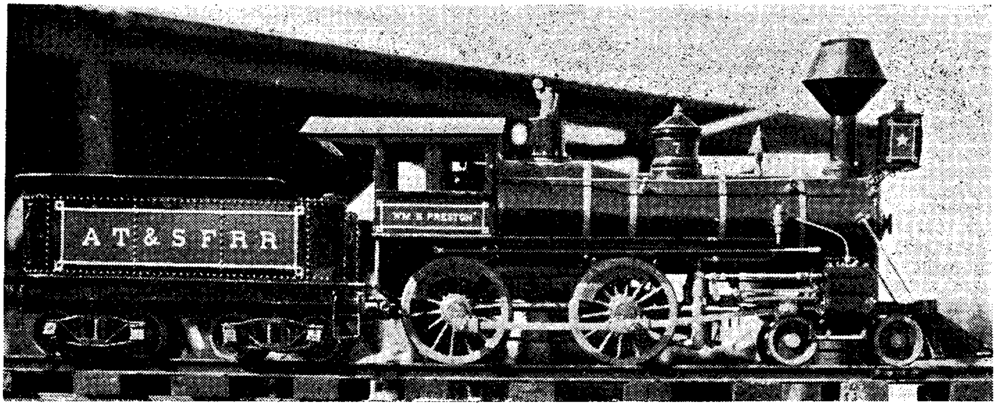


Photo by] [*A. W. Leggett*

Mr. W. Morewood's old " Sante Fe "

wheeler, *Grosvenor*, of great value when the rails are icy or greasy. When they are dry and clean, she doesn't need any sand at all. I regret having no dimensions nor particulars of either engine to offer ; it is interesting when one knows the size of cylinders, type of valve-gear, details of firebox and tubes, and so on, but the pictures themselves, and the fact that the engines were taken to the Danvers meet, is evidence that there is plenty of interest in the old-timers of U.S.A.

Shooting the Shooter !

There appeared in a recent issue, a picture of Bill Van Brocklin's 3½-in. gauge L.T. & S.R. tank engine, *Tilly*, in course of construction. The photograph was taken by Alvin Milburn, and here you see him actually on the job ! This reminds me of the time when living at my old home at Norbury ; just after the start of these notes, an old friend gave me a cheap camera—one of those ultra-simple gadgets which at that time cost only a few shillings. It had no projecting lens ; nothing beyond a hole in the front, a trigger at the side, and a view-finder on top ! But it took quite good pictures, and just after I received it, my now departed and lamented friend, Fred Crompton, came along to take a photograph or two. While he was setting up his camera, much the same way as Al Milburn has his in the picture shown here, I thought it would be a bit of fun to " shoot the shooter," so I did. The little picture came out all right, and a copy of it is even now adorning the wall of my workshop, on a piece of plywood, surrounded by photographs of L.B. and S.C.R. engines ; it is a lasting memory of poor old Fred, who passed to the Great Beyond many years ago. I still have the little camera, and it is still in working order ; but I know very little about photography, and I am not interested in taking shots of my own engines. The last photograph that the little camera took, was appropriately enough, the last trip of the steam-hauled *Southern Belle* on the Saturday afternoon before " Milly Amp " pushed the button on the Sunday. The engine was a Baltic tank No. 333,

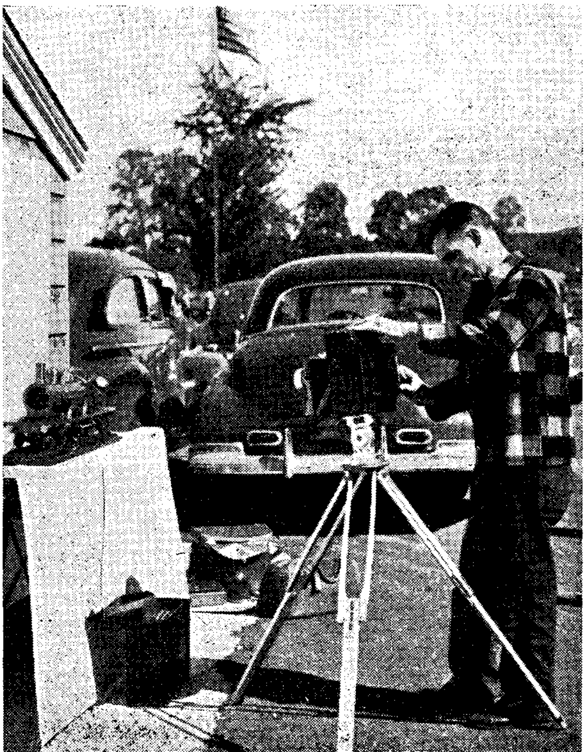


Photo by] [*A. W. Leggett*

Caught in the act !

Remembrance, and I keep the print, in remembrance, on my workshop wall. *Sic transit gloria mundi* !

Cousin to the R.H. & D.R.

Our fourth picture shows Bill Leggett Jr. and Carl Purinton on the footplate of one of the Edaville engines, on a visit to that railway after the Danvers meet. The Edaville R.R. is in some ways a counterpart of the Romney, Hythe and Dymchurch line in this country, but it charges no fares ! It is entirely a private concern, owned by Mr. E. D. Atwood (hence the name on the locomotives and rolling-stock) who runs the biggest cranberry plantation in the whole of Massachusetts. Mr. Atwood takes a great interest in locomotives and railways ; and when some of the smaller narrow-gauge lines were put out of business by bus and lorry competition, he bought up some locomotives, rolling-stock, track and equipment at cheap rates, had them transported by road to his plantation at South Carver, Mass., and proceeded to lay down a fully-equipped line. The gauge is 2 ft. The main line is 5½ miles long, forming a continuous road, and has numerous sidings, as it does the whole of the transport work of the plantation ; during the cranberry harvest, the box cars are worked to full capacity. At other times, there is always plenty of work for the freight trains, as the maintenance of a big plantation involves more in the way of transportation than most folk would imagine.

When the line was first opened, Mr. Atwood ran passenger trains for the amusement of himself and friends ; the friends were so tickled that they brought other friends, and finally Mr. Atwood threw open the line to all and sundry, with the result that last year they carried somelike 150,000 passengers ! Anybody is welcome to ride free, as much as they wish ; souvenir tickets are sold for fifteen cents, if anybody cares to buy one. The type of locomotive in use, is the 0-4-4 well tank seen in the picture. The cars are proper Pullman type cars, with plenty of room to walk about, and fitted with comfortable upholstered seats. The freight stock is a small edition of the kind used on the 4-ft. 8½-in. gauge lines. The line is properly equipped, works to a regular timetable, and has all the staff and appurtenances of its standard-gauge relations. Repairs to locomotives and rolling-stock are all done "on the premises," in a manner of speaking.

Edaville Station would do credit to any branch line, and more than one main line, in this country, being complete in every respect. The refreshment room has a lunch counter of typical American type, with a long row of stools and a high footboard, so that one can sit up to the counter and take a snack in comfort. There is another counter where cranberry products, jelly, jam, and so on, can be purchased. The whole outfit is a fine example of—well, " private enterprise " just about sums it up !—and our friends of the New England Live Steamers had a wonderful time there. I guess that I'm breaking the Tenth Commandment right away, for honestly, I envy Mr. Atwood and his 2-ft. gauge railroad ; though I am afraid, if I had it, the Pullman cars would be labelled *Southern Belle*, and a Brighton engine would be pulling them !

Beginners' Corner

I didn't hurry the description of the cylinders, because I know from correspondence how long it takes the average tyro to machine up a pair of cylinder castings, and make a proper job of it ; but by this time I should imagine most of our beginner friends are ready to carry on, so here we go. The flat covers for the steam-chests may either be castings, or merely a piece of ⅛-in. brass plate for each. If castings are supplied, they should have a chucking-piece cast on, in the centre of the rectangle ; and all you have to do, is to grip this in the three-jaw, give the cover a little gentle persuasion with a light hammer if it doesn't run truly, and then face off with a round-nose tool set crosswise in the slide-rest. File the sides and ends to the same dimensions as the steam-chest, cut off the chucking-piece with a hacksaw, file the stub flush, and smooth off the unturned side with a file. There is no need to machine both sides.

The plate cover is merely a piece of ⅛-in. brass plate, or thick sheet, sawn to a little over the size of the steam-chest, and finished to exact size with a file. It must, of course, be perfectly flat, so that when screwed down, it makes a steam-tight joint with the contact face of the steam-chest. If you are lucky enough to own a linisher, or emery-band surface grinder, a minute or so on the fast-running emery-band will iron out any small " 'umps and 'ollers " on the cover. A similar effect can be obtained by laying a sheet of medium-grade emery-cloth, or other abrasive, on something flat and true, such as the drilling-machine table, and rubbing the cover on it, keeping it well pressed down. Temporarily clamp the finished cover, plate or cast, to the steam-chest with a toolmaker's cramp ; drill the screwholes by running the drill through the holes in the steam-chest, carrying on right through the cover, and clean off any burring around the holes.

Slide-valves

The slide-valves may be made either from castings, or bar material. If cast, the metal should be of a different grade from that of the cylinders, as like metals don't " work together " so well as unlike ones ; anyway, our " approved " advertisers will attend to that part of the business, so beginners need not worry their noddles. If bar material is used, I recommend drawn bronze or gunmetal. Drawn phosphor-bronze is pretty tough stuff to machine ; but once it is done, it IS done, if you get my meaning ! I've never had to reface a hard bronze slide-valve yet, in any of my locomotives. Drawn gunmetal is a little easier to machine, and lasts what the kiddies would call " donkey's years " before needing a reface, so that may be used with all confidence. Rustless steel also works very well on a cast bronze port-face, and so does monel metal ; but both of these are about as tough as phosphor-bronze, as far as machining is concerned. The advantage of using castings, is that the cavity, and maybe the slots in the back also, would be cored out, so that not much machining would

be needed. Although careful filing would bring the casting to size, it makes a better job if the casting is chucked in the four-jaw, with one end or side projecting, and faced off with a round-nose tool set crosswise in the rest; repeat operation for the other end and side. Leave the valve a shade full on the length, to allow of a slight adjustment when setting the valves later on. You can easily shorten a valve, but lengthening it isn't quite so easy! The cavity should be trued up to the sizes given, by aid of a small chisel, which can be home-made from a bit of silver-steel, say $\frac{3}{8}$ in. diameter. Make it the same way as the one I suggested for hand-cutting the ports.

The round-bottomed slot for the valve-spindle can be smoothed out with a file; but the wider flat-bottomed one for the nut, needs to be "about right," so should be machined This can be done by the method described and illustrated for milling the rebates in the axleboxes. Either clamp the valve on its side, under the slide-rest tool-holder, or attached to an angle-plate, or to the vertical slide, and traverse it across a $\frac{1}{4}$-in. end-mill or slot-drill held in the chuck; or else hold it at the proper height in a machine-vice (regular or improvised) on the lathe saddle, and traverse it under a $\frac{1}{4}$-in. wide saw-type cutter mounted on a spindle between centres. Of course, if any beginner owns, or has the use of a milling machine, planer or shaper the job is just a piece of cake; merely grip the valve in the machine-vice on the table, and traverse it under a $\frac{1}{4}$-in. end-and-face cutter on the arbor of the milling machine, or under a square-ended tool in the clapper-box of a planer. On a shaper, naturally, the valve would remain stationary, the tool being operated by the ram.

To make the valve from bar material, you would need a piece of $\frac{3}{8}$-in. by $\frac{5}{8}$-in. bar about $1\frac{3}{4}$ in. long, to allow enough for facing the ends and parting off. Chuck it in the four-jaw—doesn't matter a bean if it isn't dead true—face the end, and part off a $\frac{3}{4}$-in. full length. By "full," I mean leave enough to allow for facing off the parted end. Some parting tools part off truly, and some don't. It isn't always the fault of the tool, at that! I gave somebody a parting tool which did the job perfectly on my Milnes lathe, because he said he could never get a satisfactory part-off, the cut being always "on the skew-whiff." With the tool I gave him, the result was the same. The lathe was one of the "all-fallals-and-no-meat" variety, and sprung under a decent cut. He eventually managed to get good results by rigging up a tool-holder to take pieces of broken hacksaw-blades, ground at the ends like parting tools. The narrow cut didn't spring the machine. The tip may be useful; anyway, it is a good wheeze for making use of the remnants of broken blades!

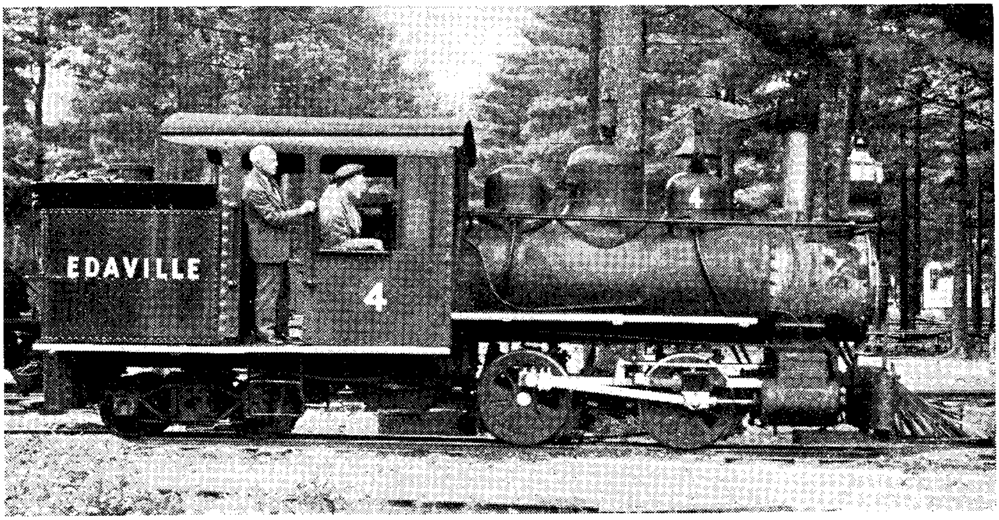


Photo by] *Outsize for the back garden?* [*A. W. Leggett*

Face off both pieces of bar to the correct length, then mark out the slots and cavities. The cavity can be end-milled out by the same process as described for port cutting. Mount the valve end-up on the vertical slide, and feed it up to an end-mill or slot-drill in the three-jaw; use the one that cut the exhaust port. By careful manipulation of the cross-slide and vertical slide handles, the marked-out space denoting the cavity, can be manoeuvred across the cutter over its entire area, and the cavity formed quite easily. When it is the required depth, viz. 3/32 in., remove the exhaust-port cutter, substitute the dental burr, and reduce the radius at the corners. It doesn't matter about the corners of the cavity being rounded, as long as they are the same radius as the ports, or within a little of it.

If you haven't a vertical slide, do the job by hand. In the middle of the marked-out cavity, either make a shallow countersink with a 13/32-in. drill, or else drill a number of blind holes 3/32 in.

deep, all over the enclosed space. Then chip away the superfluous metal with a chisel, made as described above, for finishing the cavity of a cast valve. Although much of the efficiency of the engine depends on the accuracy of the exhaust cavities, there is nothing difficult about doing the job. Anybody who can hold the business end of a chisel on a marked line, whilst they assault the butt end with a hammer, should be able to cut the cavity to the correct size. All it needs, is care and patience.

The slots in the back are cut by the same process, with the same rig-up, as described above for truing up the slots in a casting; the only difference is, that you have to cut away more metal in chewing from the solid. If any beginner has a $\frac{3}{16}$-in. milling-cutter with rounded teeth, he can cut the slot for the valve-spindle at one fell swoop. If not, don't bother to mill it at all. Just drill a $\frac{3}{16}$-in. hole lengthwise through the valve, the centre of it being $\frac{1}{8}$ in. from the top, and $\frac{3}{16}$ in. from the side; then, with hacksaw and file, cut away the bit of metal left at the top, leaving the round-bottom channel, as shown in the cross section. To get a true face on the valve, lay a piece of fine emery-cloth, or similar abrasive, on a flat surface, as mentioned for the cover job; give the valve a few rubs on it, pressing well down all the time, and moving the valve with a partly circular motion. This will do the trick in two wags of a dog's tail. The rubbing surface of the valve should show a matt surface, covered with minute scratches. These hold a film of oil, which makes the valve slide easily over the ports, and prevents any steam getting under it. If you belong to a club, and the usual "know-all-the-answers" merchant who is found in every club, starts in to tell you about my big valves being all wrong, due to the great pressure on the back, and so on and so forth, don't take any notice. It isn't the *size* of the valve that matters, but the *friction* between the valve and port face; and by maintaining a film of oil between the rubbing parts (*Tich's* mechanical lubricator will see to this) friction is reduced to a minimum.

Nut and Spindle

The nut should require no machining at all, being simply a $\frac{1}{2}$-in. length of $\frac{1}{4}$-in. square brass rod, with No. 40 hole drilled through it at the position shown in the recently-published illustration, and tapped $\frac{1}{8}$ in. × 60, if you have a tap and die for this fine thread. If not, tap it 5 B.A. The object of this fine thread is to give a finer adjustment, enabling a more perfect valve setting to be obtained. Be sure the hole goes squarely through the nut, because if the nut cants on the spindle, the valve will not seat truly on the portface; so drill the nut on lathe or drilling machine, and not by hand. The nut should fit easily in the wider slot in the valve, but must not shake. If it is tight, give one side a few rubs on a flat file laid on the bench, and ease it just sufficiently to drop into the slot; no more.

The valve-spindle is a piece of 5/32-in. round rustless steel or drawn bronze rod $2\frac{1}{4}$ in. long. Chuck in three-jaw with a little over $\frac{3}{4}$ in. projecting from the jaws, and carefully turn down $\frac{3}{4}$ in. length to $\frac{1}{8}$ in. diameter. Beginners note: if your lathe is at all "suspicious," leave only $\frac{1}{8}$ in. projecting from the chuck jaws, for a kick-off. Face the end with a knife-tool, and centre it with a small centre-drill in the tailstock chuck. Then pull it out about $\frac{7}{8}$ in. or so; put the centre point in the tailstock, and run it up until the point will enter the centre hole in the end of the rod, and support it. Don't forget a drop of oil! Then turn as above, using a roundnose tool with plenty of top rake; replace tailstock chuck, and with a die in the tailstock holder, screw the turned part to match the hole in the nut. Reverse the rod in the chuck, and put about $\frac{3}{16}$ in. of 5/32-in. × 40 thread on the other end.

The fork, or clevis, is made from $\frac{1}{4}$-in. by $\frac{3}{8}$-in. mild-steel. At a full $\frac{1}{8}$ in. from the end, in the middle of the narrower side, make a centre-pop, and drill a No. 33 hole right-through the thickness, same as you did the nut. Ream it $\frac{1}{8}$ in. Now mount the piece of rod on the slide-rest, under the tool-holder, and form a slot in it, $\frac{1}{4}$ in. wide and $\frac{3}{8}$ in. deep, by exactly the same method as illustrated and described for slotting the pump-ram; but use the $\frac{1}{4}$-in. cutter that did the slot in the slide-valve. If you haven't a cutter, file the slot by hand; care and a little patience will do the trick. Chuck in four-jaw, and part off at $\frac{5}{8}$ in. from the end. Reverse in chuck, set to run truly, face the end, centre, drill No. 30 until the drill breaks through into the bottom of fork, tap 5/32 in. × 40, and turn down $\frac{1}{8}$ in. of the outside to 7/32 in. diameter. Round off the ends of the jaws, same as described for the coupling-rods, and screw in the 5/32-in. end of the valve-spindle. Next stage, how to pack the pistons and glands, and make the joints.

B.R. Paints and Enamels for Models

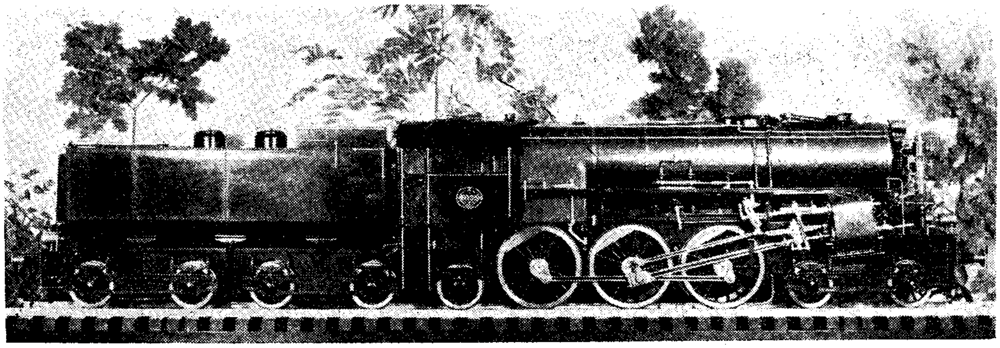
Messrs. Bassett-Lowke have just produced an entirely new range of paints and enamels in authentic colours from British Railways official samples. These paints have been prepared specially for model-makers and are of the finest quality; they cover the following range:—

Locomotive colours: Blue, for express passenger steam and electric locomotives; dark green, for selected passenger steam locomotives; black, for passenger, mixed-traffic and freight steam and mixed-traffic electric locomotives, and green for electric stock.

Coach colours: Crimson lake, for all vehicles; cream, for use with crimson lake on all main-line coaches on principal trains, and light grey for roofs.

Goods vehicle colours: Orange brown, for fitted or piped vans; dark battleship grey, for fitted vans; white for lettering, and light grey for roofs.

There are also available: Orange for lining locomotives, and gold lining for passenger coaches.



A Swedish Free-Lance Locomotive

by Allan Andersson

As a subscriber to THE MODEL ENGINEER, I write to send you two photographs of a locomotive which has been built by Mr. Sture Pettersson, of Kalmar, a town in South Sweden. He is working as serviceman in the locomotive repair-shops of the Swedish State Railways.

The model is built to a scale of 1 : 10, and represents Mr. Pettersson's own idea of what he thinks a good locomotive should be. The engine is 7 ft. long, driving wheels are $7\frac{3}{4}$ in. diameter and bogie-wheels 4 in. diameter. The front lamps are connected to the leading bogie so that the light is always on the track.

The driving crankpin is oiled by a little lubricator fastened on the little-end of the connecting-rod and gets its movement from the crosshead pin.

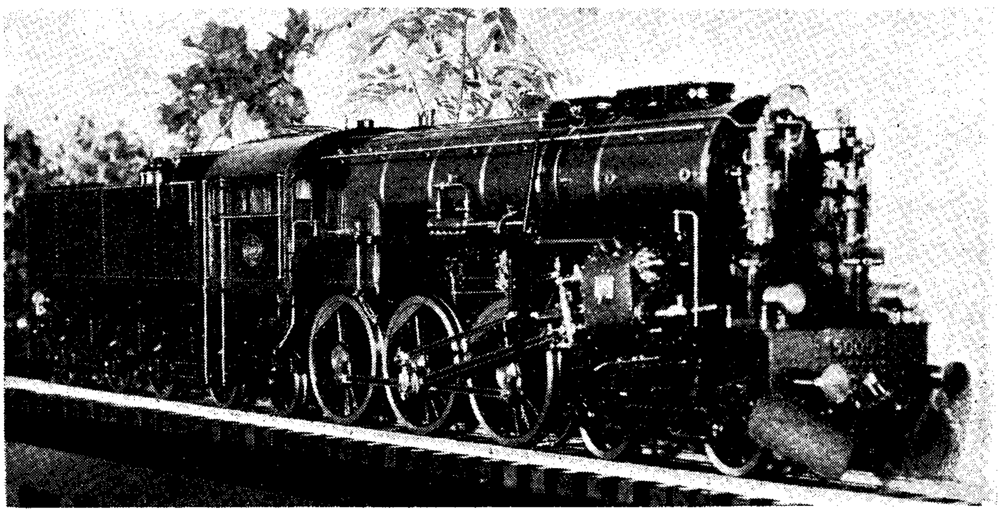
The fitting in the middle of the boiler, above the running-board, is for changing the reversing gear by steam; but a hand-operated fitting is mounted in the cab.

The engine has two air pumps in front on the smokebox. They are in every detail like their prototypes, and work very well. The cab has all the usual fittings.

The engine has piston-valves with two rings in each piston. Mr. Pettersson's engine has not been tried by steam, only by air, and worked perfectly.

I like THE MODEL ENGINEER very much, and every week I receive a copy I am first reading "Smoke Rings" and "L.B.S.C.'s" article. I hope to come to the next MODEL ENGINEER Exhibition and take a real look at what many good Englishmen can do in this kind of hobby.

[If the scale of this fine locomotive is strictly 1 : 10, then the gauge is, of course, about 5.6 in. We do most sincerely hope that there may be a possibility of having this engine on view at the next MODEL ENGINEER Exhibition.—ED., "M.E."]



*TWIN SISTERS

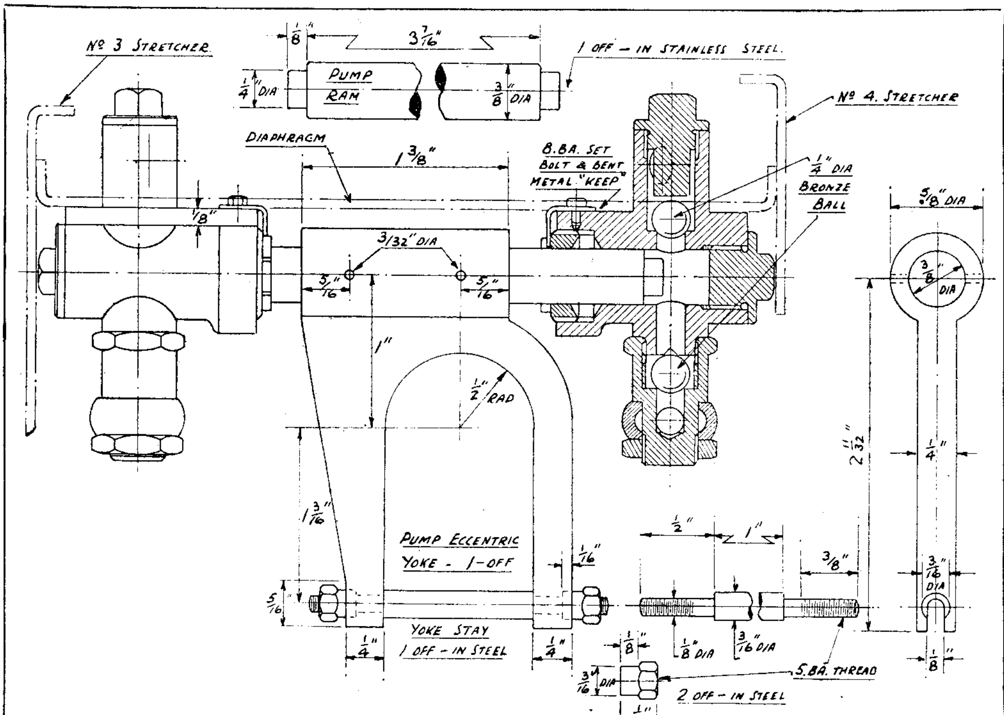
by J. I. Austen-Walton

Two 5-in gauge locomotives, exactly alike externally but very different internally

THE first real departure from the actual prototype, comes in the form of an axle-driven water-pump, shown herewith.

I want to remind you once more that this is not a compulsory feature, and those who intend later to fit a full donkey-pump type of feed, or an injector, can skip this item if they want to.

Another advantage of the opposed-type of pump lies in the ability for one of the pumps to form a guide for the other, and this cuts out still more unnecessary friction. The angular drive imparted to the normal eccentric-driven plunger pump accounts for a good deal of the pump gland leakages one sees, especially where



Personally, I like the axle-driven pump very much, especially for conditions of continuous running, and where the feed must always be proportional to the distances covered, and therefore, but not absolutely, in some proportion to the load carried, which is a somewhat different story. It is also a reliable type of pump, and in the form here presented, with the double-acting ram, the load is distributed more evenly, thus preventing that lamentable evidence of shouldering and uneven running at low speeds.

There is also the water by-pass in the pipe system, which enables the pump to idle if not required, and in this state it need hardly absorb any power at all.

*Continued from page 13, "M.E." January 5, 1950

the pump is close-coupled to the axle driving it—a condition suggestive of space shortage.

But this type of pump is not exactly new, and the famous engine "Mustang," built by Mr. D. Marshall, of the Malden society, had a pump built and fitted on very similar lines. Mr. Marshall told me that it worked perfectly, and never at any time gave trouble, nor did it leak in operation. So much for the design considerations, and now for the building details.

The pump bodies can be obtained in casting form and two are required. The pump yoke is also a casting, and one only is required; the rest of the materials are for the main part standard bar or plate. Later on, I will give some information on how to fabricate the entire unit, as I am much in favour of this method for its general

clean appearance and for my ability to be "self sufficient" without recourse to the whims and fancies of the foundry folk (bless their hearts). In this connection also, it helps readers in the far-flung outposts of the world, in that they are not waiting for weeks for the bits and pieces to be sent out. This is not the fault of the "Sender-outers" who, as a rule, are pretty good at getting goods out on time—very often by return of post; but to air mail a half-hundredweight of castings at so much per ounce might be a bit of a shock to someone.

Taking then the case of the castings being to hand, these should be thoroughly de-sanded as the first operation, and then filed up on the flash-line and other blobs and pips. Now compare the casting with the drawing; you will notice that the lower valve-chamber is cast on to about the same length as the upper chamber. This is for chucking purposes only, and this lower chamber part is held in the chuck for drilling right through the two chambers and the transverse hole through the end of the pump body, and joining the two chambers.

This entails the following:—Make sure the top chamber does not wobble about when the pump casting is chucked, and if it does, rechuck it if necessary in the four-jaw chuck. When both chambers revolve fairly concentrically, face the top of the top chamber, centre and drill $\frac{3}{16}$ in. right through to the other side, letting the drill break through. With a really sharp end-mill or a home-made D-bit, open up the hole to $\frac{5}{16}$ in. diameter by $\frac{11}{16}$ in. deep. Again open up the hole to the tapping diameter of the thread being used, that is, 26 or 40 threads and $\frac{3}{16}$ in. deep. Tap the hole.

Now turn down the outside diameter of the chamber to just clean up all round, and face off the top surface of the pump plate, also to clean up and no more. When this is done, remove the pump and do the same thing to the other pump.

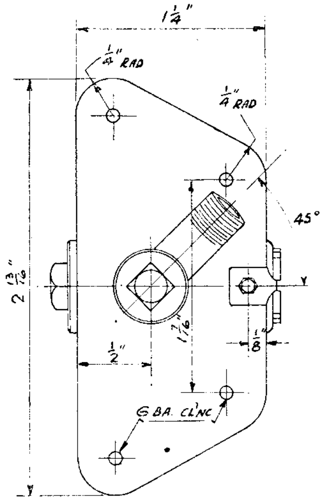
Chuck one of the units by its turned portion so that the drilled hole runs true, taking a facing cut over the end to help sighting the hole on a clean face, or by putting a small piece of $\frac{3}{16}$ in. diameter rod in the hole and centring from this. When correctly set, turn back until the face is 7/32 in. from the pump body, and turn down this projection on the outside to just clean up, in the same way as the top chamber. Turn down to $\frac{3}{8}$ in. diameter for $\frac{1}{8}$ in. length, and thread as chosen, not forgetting to put a slight undercut or run-out behind the thread. This does not weaken the part as some people imagine, provided the depth of the undercut is not greater than the core diameter of the thread being used—in other words, to the bottom of the thread.

Repeat this operation on the other pump body, afterwards cutting a good deep "vee" slot across the bottom face of each unit; this is to prevent the suction-ball blocking up the passage when it lifts.

Now we can set up to bore and thread the bodies of the pumps, and although this can be done in a four-jaw chuck where the chuck jaws are not very wide, a far better job can be done by setting up each pump unit on a small angle-plate on the lathe faceplate.

If your angle-plate has not got a convenient central slot, wide enough to allow the top chamber to stick right through, then you must set it up on two packing strips—that is, pieces of metal about $\frac{5}{8}$ in. thick, one on each side of the chamber, and between the machined plate of the pump, and the angle-plate surface. This method will ensure absolute rightangularity (I made that up, I did) of the plate surface with the pump bore, and quite important it is, too.

A couple of clamps will do the holding, and you can start on the big gland end, facing off the swelled-out portion, and bringing it to the $\frac{3}{4}$ in. dimension to the centre of the chamber line, as shown on the drawing.



PLAN VIEW OF FORWARD PUMP BODY ASSEMBLY

You are now given an alternative arrangement for the bore of the pump. The main drawing shows a through bore, with a screw plug in the back end, but there is no particular merit in this system other than giving the builder the opportunity to ream the bore right through; and some men are a bit fussy on this point, even though it would not matter if the pump ram did not touch the sides of the bore at all. The packing of the gland is the important seal, as all these water pumps work on displacement and not continuous fit, as it were. Why did I give the first system at all? Well, at the time the pump went on the drawing-board, I had ideas on an incorporated lubricator drive, that may be disclosed later on, so for the time being we will consider the more simple edition.

Having faced the front of the pump, and starting off with centring and small drills, taking these just past the break through of the cross passages, you may either drill out to size or, if the large drill shows signs of giving trouble, complete the operation with a small boring-bar or even an end-mill which, being a standard size, will most probably be found in the majority of home workshops. In any case, you will require the boring-bar for the next operation, which is to enlarge the front end for the gland thread.

Here it is well worth while making use of the screwcutting capabilities of the lathe (you *insisted* on having a screwcutting lathe when you bought it, didn't you?) and the train may be left in for the making of the gland rings to fit. More than 90 per cent. of pump troubles—mainly binding when the gland is disturbed, are due to the hole in the gland being eccentric with the thread on it, and this goes for back cylinder-cover glands as well. Very small taps, if in reasonable condition, will produce good threads when fed in from the lathe tailstock; but when you get to about $\frac{3}{8}$ in. and upwards, it is always a toss-up as to whether the thread is truly concentric with the hole drilled or bored to take it.

Having bored the hole, remember that the 60-deg. chamfer is still required and is not just an accident of drilling, and the thread put in. Safer here to cut the thread by turning the lathe by hand or in back gear, if you are not an experienced lathe operator, or are just "feeling your way" with screwcutting for the first time.

It is not absolutely essential to face off the opposite end of the pump barrel, but if you decide to do the job in style, after both pump bodies have been brought up to this stage, then any odd piece of bar, held in the 3-jaw chuck, and threaded by screwcutting to suit the female gland thread in the pump body may be used as a screw spigot on which to turn the reverse ends of the pumps. Take light cuts only, because of the overhang and the "bompety bomp" during the outward facing where it runs flush with the plate or platform portion of the casting. There is, in fact, an overall dimension for the body length, given as $1\frac{1}{4}$ in., but it is not a tight dimension.

This completes the machining of the bodies themselves, except for the drilling and silver-soldering in of the top delivery unions. These constitute the only difference between the two parts, and, when placed in position on the locomotive diaphragm, and looking from the back of the engine, these unions or branches should both face the right-hand side of the engine, and both inclined towards each other at the 45-deg. angle shown on the drawing. There is also a 10-deg. upward inclination to both branches, but both these angles are approximate and not in any way strict.

The making of the pump glands calls for very little comment except that they should be made from the bar, drilled or bored, and threaded by the lathe and not a die, all at the same time and setting, afterwards parting off; this ensures concentricity between thread and bore once more, and is quite essential.

The drawing shows a series of slots cut in the front face of the gland, and if you have no means of machining these, do the job carefully with a small file. There is a tiny keep to make, the tail of which sits in the slot when adjustment is made, and please do not skip this item. Should the gland work loose when the engine is running, and the gland foul the end of the eccentric yoke where there is very little spare clearance, it would not do the works very much good.

The suction fitting or chamber is made from hexagon bar, $\frac{1}{2}$ in. across the flats, and should be machined from the $\frac{3}{8}$ in. diameter end first. The thread here can be die-cut without trouble, and the plain portion of the body turned back, leaving the hexagon section required at the top, and parting off beyond this. Each part may now be held in the three-jaw chuck and drilled and tapped as shown.

Notice that the central long hole does not go right through the fitting, but breaks out through a cross drilling from side to side; both these and the central hole are $\frac{3}{16}$ in. diameter. The enlarged hole forms the ball chamber and seating, hence the square end to the bore. The diameter of the chamber inside may be left at the tapping size for the thread chosen, and I rather fancy the 40 series for this job, which would give us a 9/32 in. diameter.

Banjo-type unions fit the bottom parts of the suction chambers—the neatest and most compact type of right-angled pipe connection I know. If these are made with even moderate care, and the nuts that go underneath have threads truly cut, and all faces are smooth and flat, they will not leak; nor will they require jointing in any form, which is a great blessing. I hope I do not hear a voice saying that they have never seen such a fitting on a full-size locomotive, because I know that many have. Not only that, I hate to see sweeping pipes down underneath, almost rubbing on the sleepers of the track; but even this is better than the sharply kinked pipe, so treated as to bring the pipework within the lower loading gauge—so to speak.

Apart from such considerations, there is nothing in the banjo itself; the outside radius is largely ornamental for general neatness, and the smaller inside radius is to provide a water channel all round and breaking out to the side hole for the silver-soldered pipe connection.

The cap for the top chamber is shown with a square head; but this could be "hexagonised" if required or preferred. I like the look of the square, and consider it stands up to hard usage much better. I have used an old Zenith-type carburettor key for such jobs, applying a form of standardisation for all parts suited to the square-head treatment, and this simplifies the tool kit problem to a marked degree. One of these keys has been made on to a long bar handle, box-spanner style, with a permanent tommy-bar handle at the end. This is used to make water connections way up under the engine and without the need for any up-ending or turning over of the whole engine, and 5-in. gauge ——— !

Having made all the bits and pieces for the pump bodies, turn up the pump ram from a piece of $\frac{3}{8}$-in. diameter stainless-steel. Now take any old piece of tubing that will slip over the ram, and cut it and face it off to $1\frac{13}{16}$ in. long. This is your setting-piece for locating the whole assembly on the underside of the diaphragm. Drill the four fixing holes in each pump plate, and screw in the glands—not right in, but to their fullest-out position.

Slip the ram into one pump body, followed by the piece of tube prepared, and then slip on the other body. This will keep the two pump parts correctly spaced apart, whilst the ram itself will keep both in line while the fixing holes are being drilled.

(*Continued on page* 91)

An Electrical Hedge Cutter

by E. F. Scott

HAVING set that piece up in the lathe and all set to make some progress, one glances out of the window to notice, with dismay, how much the weeds and hedges have grown. Reluctantly one has to put the job down and, for the sake of domestic happiness and local amenities, adopt green fingers. The heavy slogging with hand shears on the hedges becomes real hard work, and the time taken is begrudged. This is especially so when things have been allowed to, shall we say, get slightly out of hand; as is often the case. The price of a commercial hedge cutter is also considered whilst slogging away, and one thinks that the capital required would buy some better tools for the workshop or some castings. I wondered how many model engineers my musings applied to and whilst wondering this the idea came: Why not make a hedge cutter? I became pre-occupied with the idea and in designing the replacement, did not notice the work of shearing away at the hedge by hand (for the last time).

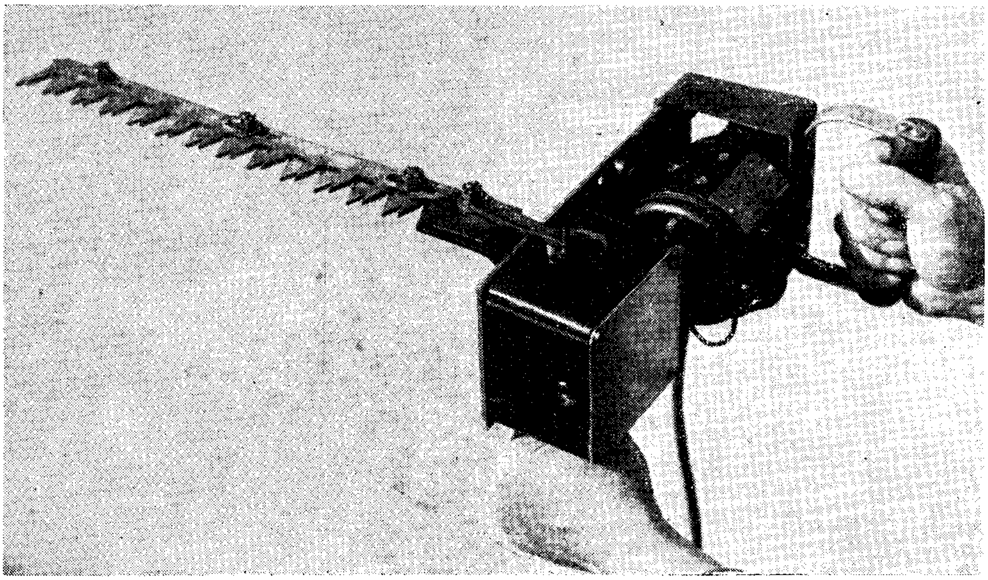


Photo by] [*Mirror Studios, Bristol*

How to hold the electrical hedge cutter

Materials

A survey of the necessary materials on hand, revealed a piece of duro $\frac{1}{8}$ in. plate (part of a Hamilcar glider), an ex-Admiralty 110 V shunt motor, and a complex gearbox made of phosphor bronze. For the cutter blades, I obtained from an "M.E." advertiser (Messrs. John Hall Tools Ltd., Redcliffe Hill, Bristol) two lengths of bright mild-steel, 2 ft. $\times$ $1\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in.

Now to work: The field coils of the motor were scrapped, a former made, and 400 turns of 28-gauge Lewmex wire wound for each coil. These were well insulated with Empire tape and fitted. The armature, without alteration, was then wired in series with the field coils, and the result was quite an efficient motor for 220 V a.c. supply. The gearbox was dismantled and the lower half cut away, thus leaving room to refit a 25 to 1 worm gear. The worm gear shaft was refitted complete with its external coupling, a longer vertical shaft of silver-steel was made and fitted complete with the crownwheel and ball-bearings. The new vertical shaft projected through the top of the box and to this projection was fitted one of the change-gear cranks, removed from the old box. A crankpin was fitted at $\frac{1}{2}$ in. centre, as the blades were to have a 1 in. throw. The box and motor were then fitted to the baseplate, as shown in the photographs.

Now for the cutter blades: The two lengths of steel were drilled $\frac{1}{8}$ in. near the ends and bolted together. The top one was then blued with some of "L.B.S.C.'s" recipe blue, and the marking out done for $12\frac{1}{2}$ teeth, as shown in the sketch. All holes were drilled $\frac{1}{4}$ in., the dot-

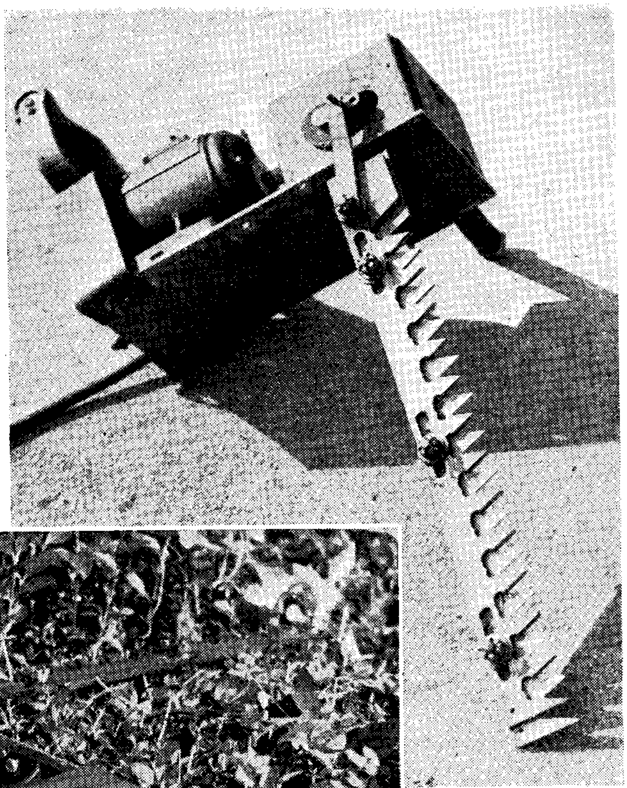
stippled holes are drilled through both plates and the other holes through the top plate only, after unbolting.

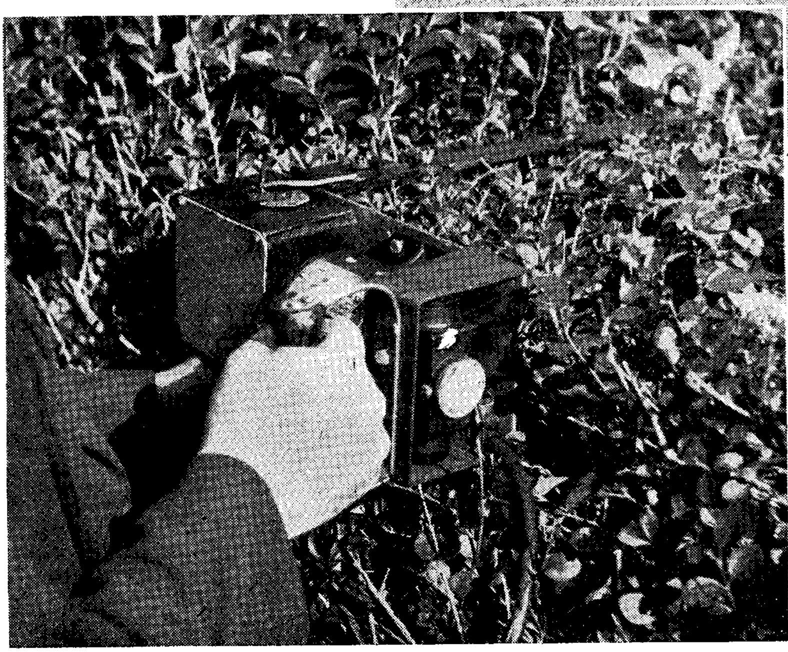
The top blade teeth are recessed to cut the larger stems and prevent them sliding out.

The plates were then rebolted and clamped in the vice, the teeth being cut with a hacksaw. Again separating, the slots were cut in the top plate with an "Abrafile." The top blade is cut off at 14½ in. and the bottom blade at 18 in. The teeth are then sharpened with a saw and rat-tail file to approximately 30 deg. to the vertical.

Construction

The bottom blade was then bent at right angles with heat 3 in. from the end ; this end was drilled for bolting to the baseplate. The three studs were then fitted to the bottom blade and a stud fitted in the top blade end for the big-end of the connecting-rod. The connecting-rod was then cut from the discarded part of the plate, drilled, and fitted. It will be noted in the photographs that the crankpin is rather long and the corresponding hole in the connecting-rod is a loose fit. This is done to enable the cutter blades when in use to have some flexibility. Now to the method of adjusting the blade pressure. Springs are no use, as when tightened sufficiently to prevent the blades opening, the friction is so great that the motor is overloaded. Other methods were tried but the following is the best of all. First, a large washer of loose fit is dropped on each stud, then a smaller tight fit washer, then the castellated nuts. Now with the machine fixed in the vice and running, each nut is tightened down until the large washer stops oscillating, and the nut is then released just sufficiently to allow the bottom washer to oscillate, after which the nut is pinned. Incidentally, all studs were brazed into the blades. A press on/press off switch was fitted to the motor, close to the flat iron handle used for a grip. A vertical





Above — Another view of the hedge cutter

Left—At work on a hedge with the cutter

[Photos. by Mirror Studios, Bristol]

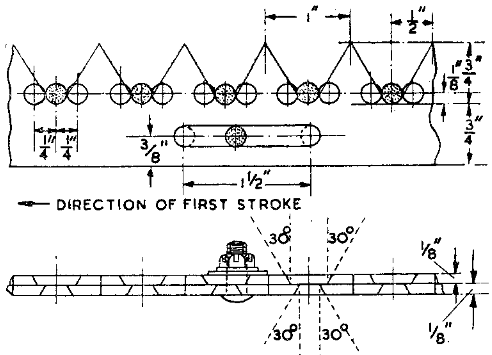
handle for the left hand is fitted in one of the spare holes in the underside of the gearbox.

The cutter does about two hundred strokes per minute and slows according to load.

It has now been used for many hours and has proved quite successful, completing the job in one-tenth of the time previously occupied.

Note of precaution: If a motor is used at mains voltage, it is necessary to use a three-core cable and to effectively earth the frame with the third wire. There is no reason why low voltage motors could not be used, provided a suitable step-down transformer is provided. To those with small mobile compressors — what about a piston-driven job?

The total cost of the cutter was 19s. 2d.



Details of the cutter blades

Internal Combustion Turbines

K. N. Harris writes :—" Quite recently, in the columns of THE MODEL ENGINEER, the application of the internal combustion turbine to locomotive work was most disparagingly referred to, on the grounds that quite a large proportion of its *gross* power output was absorbed by the compressor.

I am concerned neither to attack nor to defend the application of internal combustion turbines to locomotives, their suitability or otherwise, for this purpose will settle that matter in due course, with a complete disregard for any prejudices held by model engineers.

What I am concerned about is the complete falsity of the argument used to condemn the internal combustion turbine; engineers among your readers will not need to have this falsity pointed out, but THE MODEL ENGINEER is read by a great many people who are, in the purely technical sense, uneducated, and such is the power of the printed word that many, not in a position to judge for themselves, are likely to accept arguments of this nature as being valid.

What matters in assessing the thermal efficiency of any prime mover, is not the power absorbed by ancilliary equipment necessary to its operation, but the *usable* power it produces per unit of fuel burnt, that and nothing else. On this basis the i.c. turbine is ahead of any steam plant and miles ahead of the very best steam locomotives of normal type. Had your contributor based his criticisms, I might well have used the word 'antipathies,' on the high first cost, or the maintenance cost, or the necessity for reduction gearing, he might have made some sort of valid case. One might just as well attack the ordinary petrol engine for wasting heat through the water jacket, yet the small petrol engine is a far more efficient engine from the thermal point of view than the small steam engine.

I suppose big power station plant or marine plant must be condemned on the same grounds; their condensing gear absorbs very considerable power to operate it! One has only to state the case thus for its utter absurdity to appear.

I have no love for the turbine, either steam or i.c., but I have a very lively appreciation of the rapidity with which it is developing, and of the fields that it is likely to enter in the future.

The steam locomotive of one hundred and twenty-five years ago had to contend with exactly the same sort of prejudice and opposition as the i.c. locomotive in general now meets; truly mankind does not alter or develop much fundamentally!

Ill-informed criticism of rival forms of motive power will do absolutely nothing to arrest their progress, or to retain the steam locomotive; that will survive just as long as it meets the requirements of the situation as a whole more efficiently than can its rivals.

Unless the steam locomotive can make considerable strides in the near future, it is doomed; its final disappearance may be long deferred (the longer the better !), but the steam locomotive as we know it today is on the way out. If it does survive, it is long odds it will not be to the Stephenson type. When one of the biggest firms of locomotive builders in the world, drops completely the manufacture of steam locomotives, to devote its plant and energies solely to i.c. locomotives, the writing is on the wall for all to read except the wishful thinkers.

The best way to preserve the steam locomotive is to go all out to improve it in every possible way, even if that entails a complete departure from tradition; merely to use unsound arguments against its rivals is utterly futile."

PETROL ENGINE TOPICS

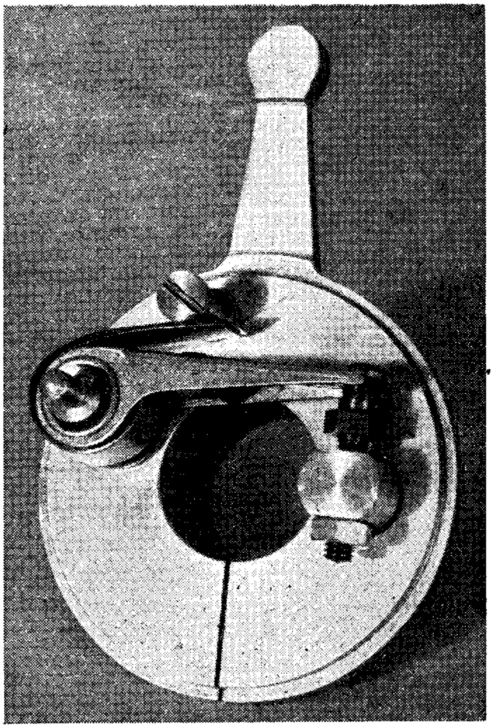
*A General-Purpose 15-c.c. Two-Stroke

An Elementary Exercise in Model Petrol Engine Construction

by Edgar T. Westbury

IF the engine is to be used for driving a boat, a simple type of direct coupling will be found convenient, and this may take the form shown here, which works in conjunction with the usual ball and pin joint on the propeller or transmission shaft. This arrangement constitutes the lightest and most compact type of true universal joint, and despite its shortcomings—the worst of which is that, being very highly stressed, it is liable to rather rapid wear and tear, it has proved to be quite as satisfactory in practice as more elaborate devices. But for continuous duty in driving a machine with considerable inertia, such as an electric generator, a form of coupling which takes the stress at a greater radius, and preferably incorporates some resilient device—such as the well-known Hardy flexible disc, for instance—will be found to work more smoothly and have a longer life. Whatever form of universal coupling is used, it should not be expected to cope with any greater angular misalignment than is absolutely necessary ; even the most efficient coupling is bound to waste power in changing the angle of drive, with consequent friction and wear.

The coupling illustrated is intended to screw on the crankshaft in place of the ordinary crankshaft nut, and the extended sleeve is slotted to take the pin of the ball joint. It should be case-hardened, but the internal threads are best left soft, which is easily ensured by screwing a stud or bolt into them during the carburising process. It will be obvious that if a right-hand thread is used, the coupling can only transmit power in an anti-clockwise direction (looking at the slotted end), which is usually most convenient for driving the propeller shaft of a boat. It may be fitted to either end of the crankshaft, provided that the engine is arranged for the appropriate direction of rotation, which should always be towards the direction of cylinder offset, or in other words, the crankpin should move upwards on the transfer port side and downwards on the exhaust port side. As the two ends of the crankshaft are interchangeable (or should be), to fit either main bearing, alterations in this respect are only a matter of assembly.



The contact-breaker assembly removed from engine

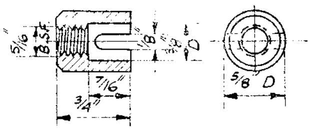
Contact-breaker

On the smaller sizes of engines, it is often found very difficult to design a really efficient contact-breaker which is in reasonable proportion to the rest of the engine ; but this problem is simplified here, owing to the more comfortable size of the engine, and it is possible to use an enclosed, but readily accessible contact-breaker, using standard automobile components. Here again, adaptability has been carefully studied, and practically any type of contact-breaker rocker arm used in modern car practice can be fitted to the ample-sized backplate. The one shown is taken from the Lucas range of components, but similar or practically identical types are made by Delco-Remy and other manufacturers. In some cases details vary, such as long or short springs, and different electrical connections, but these only call for slight modifications in the positions of the holes in the

*Continued from page 13, " M.E.," January 5, 1950.

backplate. The required components are not only obtainable from any service garage, but can often be obtained in reasonably good condition from the garage scrap-box or car-breaker's yard. It is only necessary to make quite sure that the contact tips are not burnt away to such an extent as to make refacing impossible without cutting them right away to the steel backing. The two contacts should be quite bright and true, one or both being slightly convex on the face so that it makes a firm contact in the centre only.

The position of the components should be very carefully laid out on the backplate so that the contacts are correctly located in relation to each other and the fibre pad of the rocker arm comes centrally over the cam circle. It will be seen that the contact screw block and stud are insulated from the backplate by a bush and washer of fibre, ebonite or bakelite. The centre of this stud comes out very close to the boss of the backplate and it will be necessary to mill or pin-drill a part of the boss away to accommodate the nuts which secure the stud. These constitute the low-tension terminal and must obviously be well clear of other metal parts. To avoid disturbing the contact block when once secured, it is a good policy to fit a solder tag or



Coupling

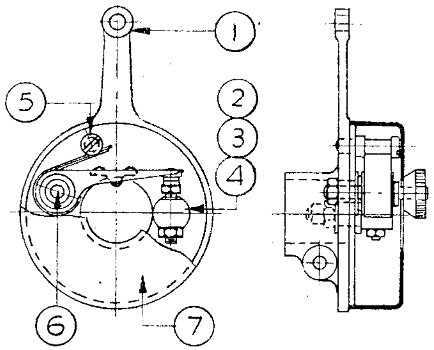
a connecting strip permanently under these nuts, for facility in making connections.

An alternative form of construction is to earth the contact block, which may then be permanently bolted or riveted to the backplate, and insulate the spring stop-stud, making certain also that the rocker arm is insulated from its pivot stud, by a fibre bush, and also from the cam, by its fibre rubbing pad. Although most standard components are made in this way, I have occasionally encountered trouble with short-circuits with them, and have found the insulated contact block, if not more satisfactory, at least easier to check up on.

In some cases the contact screw is dispensed with, and the contact attached to a plate which is adjustable in an arc around the centre of the rocker pivot, and can be clamped at the contact end by a locking-screw. This is an excellent arrangement, especially if an eccentric adjusting device is also fitted, but I have found it difficult to work in the existing contact plate within the limits of a small assembly, and although a new plate is easy enough to make, it is by no means so easy to transfer the contact point to it without risk of damaging the tungsten tip.

The machining of the backplate is very simple, as it can be held by the boss for boring, turning the cover spigot, and facing at one setting; then reverse and face the rear side. It should be a tight wringing fit on the nose of the bearing housing; no sloppiness here should be tolerated, as this is a common cause of ignition trouble. It is true that the frictional fit can be adjusted by the pinching screw, but if the initial fitting is poor, it will only "fit where it touches," and when the contact-breaker is shifted to adjust the timing, the point clearance is liable to alter.

After drilling and tapping the cross hole in the lug of the boss, it is split by a saw cut from

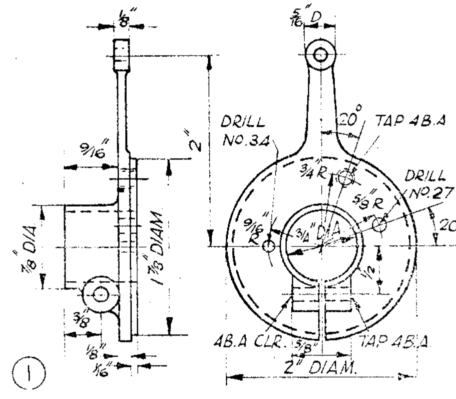


Complete contact-breaker: 1, *backplate*; 2, 3, *and* 4, *contact block assembly*; 5, *spring stop*; 6, *rocker pivot*; 7, *cover*

the lower edge of the plate into the bore. A very simple way of doing this is to place the backplate, rear side up, on the toolpost stud of the lathe, with a distance-bush underneath to bring it roughly to centre height and a washer and nut to clamp it in place. Offset the boss eccentrically on the stud to give as much clearance as possible for the slitting saw, which is run on an arbor in the chuck or between centres.

Contact-Breaker Cam

The recommended method of machining this is to hold a piece of mild-steel bar about $\frac{3}{4}$ in.

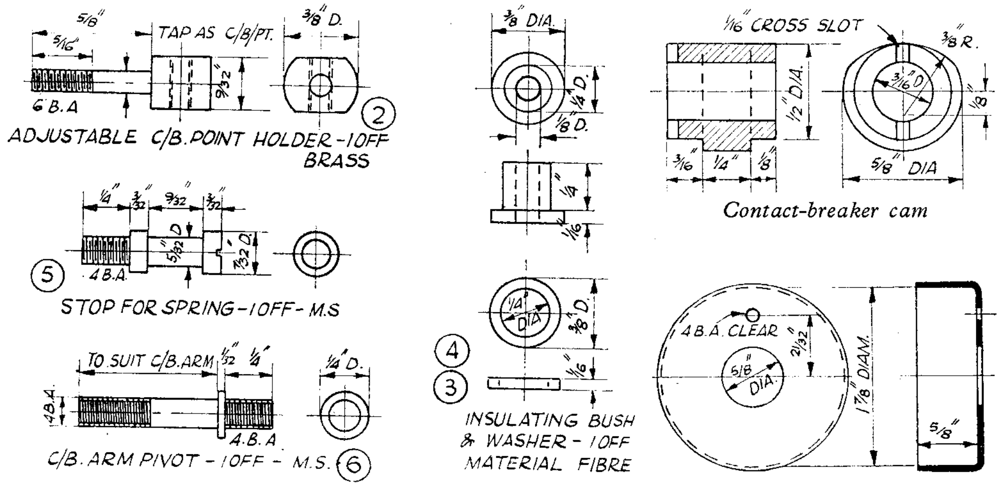


Details of contact-breaker backplate

diameter and, say, $1\frac{1}{2}$ in. long, in the four-jaw chuck, face and centre it on the end, centre-drill, and follow up with drill and reamer to $\frac{5}{16}$ in. diameter, taking great care to ensure a perfectly true hole. The outside of the cam is then turned, with as smooth a finish as possible

on the working surface or " base " circle, though the term is not really appropriate in this case. It is best to work from the rear side of the cam (the end which will be slotted) in case the reamed hole may be slightly tapered. Without removing the work from the chuck, set the jaws over about ⅛ in. (it is not necessary to split hairs over this measurement) and machine the cut-away to remove about 120 deg. from the base circle.

popular on model petrol engines, and where a cover does happen to be provided, it is quite common for it to be thrown away or mislaid at the first provocation. The reason for preferring an exposed contact-breaker is probably much the same reason for the shcool teacher placing the bad boys in the front row of the class room—namely, in order to have them readily accessible in case of trouble! But there are



Small components of contact-breaker (subject to modification to suit type of rocker arm used)

(7) CONTACT BREAKER COVER 1 OFF - MATERIAL. 20G. AL.

This form of cam is much better than the usual flat filed on a disc, giving smoother operation and much less wear and tear on the rocker, besides reducing mechanical loss. The cam may then be cut off from the bar, faced up on the back, and slotted; then after ensuring that it is a tight push fit on the shaft, it may be case-hardened and polished.

It has already been noted that the shaft has a pin fitted to the appropriate end to locate the cam in its correct timed position. This pin should not be regarded as a driving key, as the cam will get its drive quite effectively by the clamping friction of the nut or screwed coupling, but it saves having to check up on position whenever the engine is assembled, and guards against risk of possible slip. The position of the pin or the slot in the cam may be subject to variation according to the position of the contact-breaker lever, but it has been found desirable to locate this about horizontally, in which case the pin may be in line with, or in opposition to, the crankpin, and the cross slot in the cam in the position shown. It is not necessary to slot the cam right across, which has been done for convenience, but if one takes the trouble to file or mill a slot on one side only, it will avoid the possibility of getting a 180 deg. error in timing—though there is no excuse for any intelligent constructor doing so, anyway!

Contact-Breaker Cover

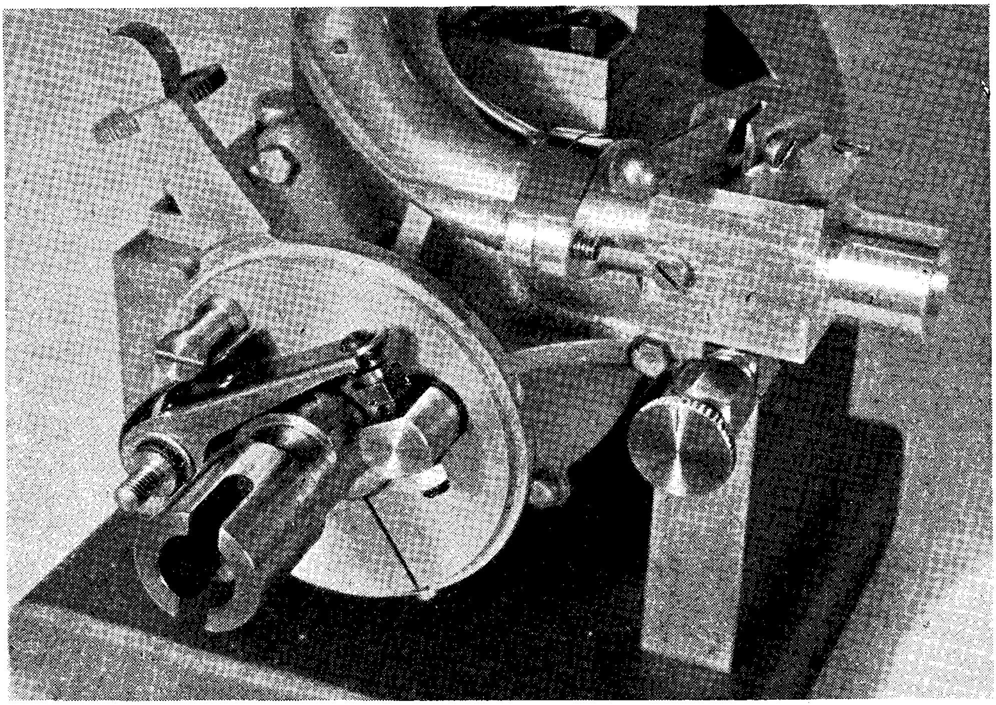
Enclosure of the contact-breaker is not at all obvious advantages in protecting the contacts from water and dirt, though in some cases the most insidious enemy—oil—comes from within, especially in engines with short bearings and using an abnormal amount of oil in the fuel. Oil throwing can, however, be prevented by sensible design of the contact-breaker, though no power on earth will prevent it *creeping*, if it is allowed to accumulate in the contact-breaker assembly. This trouble has not been prevalent in the present engine, but if it should occur, a possible remedy is to fit a felt wiper pad on the lower part of the backplate (there is plenty of room for it), to rest lightly against the cam, with a hole or notch in the plate below it to drain away the oil collected. But should the user of the engine prefer to leave the contact-breaker open, the casing may be dispensed with entirely.

The casing was produced by spinning from a 3 in. diameter disc of No. 20 gauge *soft* aluminium sheet (not duralumin or other hard alloy) which was initially annealed by the usual " handy " method of smearing soap on the surface and heating until it turned black (this is just a simple temperature-indicating dodge), before plunging in water. A metal former of the required internal shape and size was held in the chuck, with a centre bolt to clamp the disc to its face. A stout rectangular bar was held in the toolpost of the lathe, with a number of holes to take a vertical bolt or peg to act as the fulcrum for the long-handled burnisher used as the forming

tool. The metal is kept well greased, and for the simple shape shown, two or three annealings should be sufficient to spin it down closely to the former; but do not force the pace or allow the metal to harden up to brittleness before re-annealing. After spinning, trim the edge of the cup with a turning tool before removing from the former.

In the case of engines which have the shaft coupling at the contact-breaker end, the hole in the casing is made large enough to clear the coupling, but if only a nut is fitted here, it is possible to omit the centre hole. This, however, demands a different method of holding the disc for spinning, as it obviously cannot be bolted to the face of the former. The usual way is to use a disc of wood, metal or fibre for a pressure pad, having a ball thrust-race at the back, so that it can be pressed against the disc by the tailstock centre, and it is thereby gripped sufficiently tightly between the pad and former to provide the drive.

The rocker arm is retained on the pivot stud by a thin nut, and the stud is extended to pass through a hole in the casing and secure it in place with a knurled nut. There are several alternative methods of holding the casing in place, such as by fitting spring clips, and this is, of course, an optional fitting, but the single nut is simpler and has been found quite satisfactory.



A close-up of the contact-breaker and carburettor

(*To be continued*)

Twin Sisters

(*Continued from page* 84)

When the positioning has been done, and the assembly clamped in place, have a look at the top position or right way up of the engine to make sure the connection points are placed as described—you may have got the assembly back to front.

Once everything is correct, drill through the holes in the pump plates and insert bolts as you go. This operation done and the piece of tube removed, you should be able to slide the ram back and forth quite freely, and without cheating with a few loose bolts either.

If the ram will not do any of the right things, there is no need to despair; you may have gone wrong slightly with the facing cut on the pump plate, or with the bore.

Note where the pump tends to lift or where the bind occurs, and slightly set the diaphragm to remove the error. You may have made the diaphragm out of flat in the first place, in which case it is soon remedied.

On no account use a lot of little bits of shims or packing-pieces; you want to be able to whip the pump off at any time in case of trouble or stoppage, and to replace it without wondering if you put the right bits of shim metal in the right places.

(*To be continued*)

PRACTICAL LETTERS

International Backwash

DEAR SIR,—In THE MODEL ENGINEER dated December 15th, Mr. F. J. Buck rather dolefully states that it is almost impossible for an individual amateur to compete successfully with top-notch firms in the production of hot stuff i.c. engines. I would say to Mr. Buck, cheer up, the amateur back room boys are very busy doing the "impossible" which, however, "takes a little longer" to achieve. Things are happening and we may even reach the stage when the boot will be on the other foot and the commercial boys will be saying "Impossible"—what will they do then? Maybe "Internationals" at which amateur products will be restricted, who knows?

There have been many "impossible" phases during the life of THE MODEL ENGINEER—ask Curly!—and I, for one, honestly believe that never has such enthusiastic skill and patience been so paramount among the amateurs as it is today. Good luck to them and more power to their elbows!

Yours faithfully,

Orpington. G. J. GABLE.

International Racing

DEAR SIR,—I feel that this correspondence has wasted too much valuable space, and has degenerated into a slanging match which is no credit to anyone. I would have preferred that a little space had been devoted to an acknowledgment of Mr. Jutton's sterling work in lifting the 15 c.c. record nearly 10 m.p.h. in one season; this, I consider, is something to crow about. Incidentally, I have never heard him moan about the fuel.

Yours faithfully,

London, S.W. P. JACKSON.

Making Name-plates

DEAR SIR,—I was very interested in the article regarding "Making Name-plates" and I am sure that many of your readers will find it most helpful. One or two points, however, do not appear to be clear to the layman, so I hope that your contributor will forgive me if I draw attention to them.

Part of my work consists in doing finished art work for the printing trade and I often draw for letterpress blocks, so that I can speak from experience.

Lettering at any time is difficult to the layman, but in reverse, even more so, and your readers will, no doubt, like to know that if they ask the blockmaker to insert a prism in his camera, they can supply him with drawings the correct way round and he will charge no extras.

They should also ask for the blocks "unmounted," as most blockmakers will probably mount them type-high as a matter of course.

The ink used for the drawings should be indian ink (black) and the paper should be as white as possible. Both these points should help towards a finer finished result.

One last point—keep the letters fairly heavy. The down-strokes should not be any less in proportion to the total width of the letter, than those shown by Mr. Hughes, otherwise on reduction, they may prove to be too fine and break during processing.

Yours faithfully,

Newcastle-upon-Tyne. GEORGE H. ELLIOTT.

DEAR SIR,—After reading the article by W. J. Hughes, I find that there are two points that may simplify the procedure for anyone contemplating use of this method.

First, Mr. Hughes states that the drawings should be in reverse—this is a grave mistake! The original drawing can be made up from letters that have been cut from a book or poster, but I must add, that for best results they should be on a good class paper and that is nothing as rough as newspaper.

When the plate is ordered from the blockmaker, all that you require to do is to give the size, and put on the order "Reverse left to right." This is a common procedure, which only means that when the blockmaker makes the print on metal, he uses the negative the other way about. This can be made clear if you make an experiment with an ordinary negative, making one print with the emulsion side down, and one vice versa. I think that I am safe in saying that there is not an extra charge for this "reversing," unless things have changed since I had dealings with the blockmaking trade.

Yours faithfully.

London, E.16. R. A. NEWMAN.

DEAR SIR,—In your issue dated December 8th last, you published a very interesting article by Mr. W. J. Hughes in which he advocated the use of line blocks for locomotive name-plates. This is a very ingenious adaptation, but may I point out that it is not necessary to make the drawings in reverse as he states.

The "reversal" in blockmaking is obtained by the use of a prism which is mounted on the lens of the process camera, and if this unit is omitted then the plate will be the same way round as the drawing when viewed, i.e. the wrong way round for printing. If, however, the blockmaker is unwilling to meet the customer to this extent because the size of the order does not justify it, then two other alternatives are available; these are as follows:—

(1) Have the drawing photographed on a process plate, and a "projection" print made by putting the negative the wrong way round in the enlarger.

(2) Make the drawing in the usual way, but with white letters on a black background. Have a paper negative made from it by the reflex printing process on document paper. This will give black letters on a white ground in reverse as in the case of No. 1 above.

Yours faithfully,

GERALD LAMBERT.

(Chairman, Bury St. Edmunds M.E.S.)

Colouring Metals

DEAR SIR,—Reading Mr. Birchon's otherwise excellent article "The Colouring of Metals" ("M.E.," December 8th, 1949, p. 740) there are two points to which exception can be taken.

The first is the immersion of oily work in a nitrate bath to obtain a spring-blue colour. The following is a quotation from *Cassel's Heat Treatment and Case-hardening Handbook* published by Imperial Chemical Industries Ltd.

"Tempering salts contain nitrates and should never, therefore, be mixed with cyanide, since the two react violently if heated. For the same reason combustible material like oil or wood should not be brought into contact with the molten salts. Parts oil-quenched from a cyanide bath should be washed before tempering."

Nitrate baths can be used for bluing steel but the parts should be oiled after treatment to preserve the oxide film.

The second is the use of mercury for plating brass articles. Mercury is highly poisonous and even at room temperature it has a sufficiently high vapour pressure to give a toxic concentration in the surrounding atmosphere. This is apart from the risk of "season cracking" of the brass so treated.

Yours faithfully,

Runcorn. R. E. MITCHELL.

"What is the Use of it All ?"

DEAR SIR,—Seeing this remark in "Smoke Rings" recently is the cause of this letter in which I will endeavour to give an answer to the query of the young lady (and others), from my point of view.

Two weeks ago, it was found advisable, for health reasons, to retire on pension, two valued employees who had held important supervisory positions for many years with our company. The reaction of these two men, who happen to be brothers, was entirely different. One man said : "What am I going to do with myself ?" The other was all smiles and said : "Now I can get busy on the things I want to do."

I will find myself in a similar position next April, when I retire. My hobby is model engineering and I certainly will not have to ask what I am going to do with myself.

To a young person the foregoing will not seem relevant, it is too far away ; but the passage of time, all too soon, will alter that. This is one answer to the young lady's query.

There are many other answers, of course. How, for instance, are young people of the future to get a knowledge of the development of engineering from its early days, unless painstaking model engineers make prototype models of the beautiful engines and machines which such men as Newcomen, Trevithick, Watt and a host of others made in the long struggle to harness power ? Here, in Toronto, some of the members of our local society are working with this latter point in view and are producing prototype models of historic interest and design. If anyone has the temerity to ask us "What is the use of it all ?" they are just asking for a terse, indignant reply accompanied by a look of pity, because we model engineers feel that, as we say on this side of the Atlantic, we have got something. One could enlarge at great length on the text which caused this letter.

Take another and my final point. To how many of us is given the opportunity of producing something completely, with our own hands in this present-day world ? Yet I like to think, that most of us have this desire. In that belief, I may be wrong ; perhaps we are evolving a generation for whom creative work has no satisfaction. If this is so the world is going to be a worse place than it is now, which is not a very happy thought. If this should happen to catch the eye of the young lady who asked the question, I beg her to encourage her companion's interest in our hobby. She can be assured she will never regret it. In the meantime, I will continue to wander into my workshop, firm in the knowledge and belief that I have the answer to "What is the use of it all ?"

Yours faithfully,

Toronto. G. B. AGAR.

To Lead—or be Led ?

DEAR SIR,—In your issue for November 17th, there is an Editorial and a letter from Mr. E. G. Clark, both bearing on the same subject, the increasing tendency for model engineers to become "mere assemblers."

That the tendency is there and that it is a growing one, no thinking person can doubt. Unquestionably, it is in line with the modern tendency to sit back and "let George do it." We are insured, educated, rationed, doctored, recorded, docketted, directed and generally shoved around, until many of us have completely lost the urge, and in many cases the power, to help ourselves, or even to think for ourselves.

If I suggest that so far as this state of affairs affects model engineering, THE MODEL ENGINEER is not entirely free from blame, I shall be greeted with anything from wholehearted agreement through mild-eyed surprise to furious recrimination ; nevertheless, so it is. For years now, THE MODEL ENGINEER has tended more and more to stress and to give space to purely instructional matter of the "Mrs. Beeton Cookery-book" type, and to devote less and less space to articles dealing with general principles and the underlying laws behind them.

Now, I have the greatest respect for Mrs. Beeton and her methods, they have without question enabled many thousands of housewives to become passable or competent cooks, but to the art and progress of cookery they have contributed exactly nothing. The parallel may be followed exactly in model engineering.

This sort of thing is, in effect, doing the other fellow's thinking for him ; today there are lots of "other fellows" only too glad of this.

Now, from being saved the trouble of "thinking," to being saved the trouble of "doing" is but a short step, and the astute individual with an eye to business promptly proceeds to facilitate and exploit this, perfectly legitimately and perfectly honestly.

It is no use bemoaning a state of affairs we don't like unless we are going to do something about it.

In my opinion, this drift will continue and increase in volume, unless the rising generation of model engineers can be made to take an intelligent interest in first principle, and that will not be done by feeding them on a continuous diet of instruction on how to make this, that or the other and a complete neglect to provide the material and information which would enable them to do some constructive and critical thinking on their own account.

Not so long ago in your columns, a contributor, in criticising a certain job, said, in effect, "I know the man who built it and he is a good workman, but he *will* try to improve things." Just imagine the audacity of the miscreant! So long as that spirit is allowed largely to dominate your space and policy and the thinking man is regarded and treated as a suitable butt for shafts of puerile humour, it is no use bemoaning the tendency for modern "model engineers" to ease up on "doing" for themselves, as you are aiding and abetting them to with their "thinking."

Strikingly appropriate seem to be a few lines from Kipling's "Natural Theology":—

"We had a kettle, we let it leak;
Our not repairing it made it worse.
Now we've had no tea for a week;
The bottom is out of the Universe!"

Verb. sap.

Yours faithfully,

Wealdstone. K. N. HARRIS.

Boiler Lagging

DEAR SIR,—I was most interested in "L.B.S.C.'s" recent remarks on boiler lagging. He suggested the use of thin brass or copper for the outer cleading sheets on small locomotives as a more satisfactory alternative to planished steel, which is liable to corrode. I would suggest that aluminium is better still, for the following reasons:—

(1) It is cheap and easily obtainable.
(2) It is easily worked.
(3) It takes paint better than brass or copper.
(4) It is in accordance with full-size practice.

As regards (4) above, it may possibly surprise some readers to know that aluminium is sometimes used in actual practice, as indeed it surprised the writer on a recent visit to the C.I.E. locomotive works at Inchicore, Dublin. I noticed that a number of locomotives which were undergoing repair were being lagged with *wood*, which in turn was covered with aluminium cleading. I expressed some surprise at this, as I had never previously seen these materials used for lagging locomotive boilers. I was informed that, owing to the difficulty and high cost of obtaining the more usual materials, i.e. asbestos and steel, the C.I.E. had resorted to using wood and aluminium, as both these materials are easily obtainable. Experience had shown that they served the purpose almost equally well.

Yours faithfully,

Cheam. D. J. W. BROUGH.

CLUB ANNOUNCEMENTS

The Coventry Model Engineering Society

The annual general meeting was well attended and with a few exceptions the officers are the same as last year.

We are looking forward to a good year at the various regattas and the programme of visits, we hope, will be on a much more extensive scale.

Hon. Secretary: W. J. DEAN, 52, Morris Avenue, Wyken, Coventry.

Radio Controlled Models Society

At a meeting of the Radio Controlled Models Society held recently at the Grand Hotel, Colmore Row, Birmingham, it was decided that a Birmingham Area Group of the society should be formed in Birmingham. The meeting was attended by between 40/50 interested enthusiasts and the decision to form the group was unanimous. The earlier portion of the meeting was under the chairmanship of the chairman of the society, Mr. R. Lawton, but after local officials had been appointed the newly-appointed local chairman, Dr. A. C. Dawes, took over, and after duly thanking the various headquarters officials for the support they had given to the effort to form this new group, he then continued with discussions on local matters. Any persons in this area interested should contact the Group Secretary, G. F. GOLDING, 32, Beechfield Road, Smethwick, Birmingham.

London Area Group

The London Area Group of the society continues to make good progress and well-attended meetings are held each month at the St. Ermins Hotel, on Sundays, at 2 p.m. Dates of future meetings of this group have been fixed for February 12th and March 12th. Any person interested should contact the Group Secretary, LT. G. C. CHAPMAN, Pine Corner, Heathfield, Sussex.

Manchester Area Group

This being the first group of the society, it has naturally held more meetings than the others, and here it has been found more satisfactory to hold monthly meetings on different days, Saturday one month, and Sunday the next. The Saturday meetings are held in the Milton Hall, Deansgate Manchester. Dates for future meetings have been fixed for February 18th and March 19th. Further details regarding this group can be obtained from the Group Secretary, L. WITCOMBE, 12, The Crescent, Prestwich, nr. Manchester.

Additional Groups

Consideration is very shortly to be given to the formation of more area groups, and it is expected that a group in Yorkshire will be next on the list, after which there will be a further addition in the Southern portion of the country.

Future Plans

Arrangements are now being made for the society to have a stand and give demonstrations at the Second Northern Models Exhibition which will be held in Manchester next March 24th, 25th and 26th.

Arrangements are well in hand for the holding of the first International radio-controlled model boats contest in this country. This will be held on the famous International Pond at Fleetwood, Lancashire, on Easter Sunday and Monday, this year.

Radio control will be represented through the society in the Festival of Britain, 1951, and demonstrations of various types of radio-controlled models will be given on six days during this Festival.

The society is keen to co-operate with all sections of the model movement from the radio control angle and hopes that all will band together so that this country may maintain its lead in this model field. The Radio Controlled Models Society was the first organisation of its kind to be formed in the world.

Further details regarding the society can be obtained from the hon. secretary, who will be pleased to hear from any radio control or prospective radio control enthusiast from anywhere in Great Britain or the world.

Hon. General Secretary: J. HEATHCOTE, 8, Henniker Street, Swinton, nr. Manchester.